Modeling and Analysis of the Process of Resolving Regional Conflicts under Disaster and Development Risks: Case Studies from Japan and India

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CHAPTER 1: INTRODUCTION

1.1 Disaster and Development Risks, and Regional Conflicts

Commonly, conflict occurs if different parties wish to affect their aspirations as much as possible, thus leading to a trade-off state. Quite typically, disaster mitigation and economic development needs to be traded off. It is also true that crucial conflict can possibly challenge the concerned parties to increase their coping capacity, which could entirely change the quality of the conflict. Unfortunately the integration of disaster risk management and conflict resolution has not been well explored so far, but this aspect must be addressed in the integrated disaster risk mitigation policy. Sometimes the unplanned development project causes the disaster risks to the immediate community. The local resource exploitation is another territory of potential conflict. Excessive and improper exploitation of natural resources tends to trigger disasters and in consequence, people's survivability comes under threats. Wisner (2003) mentioned the importance of human rights and conflict resolution in the core agendas of development and risk reduction policy. He further pointed out that, "Globalization has encouraged the migration of millions of workers – many of them illegal or undocumented-to the industrial centers of the global economy and export enclaves ('free trade zones') within developing countries. Others are unfortunate enough to live in regions within which criminal and/or corporate elites contest control over oil, minerals, and drugs. There is little evidence that the human rights of people in these hazardous situations are being protected nor that such conflicts are becoming fewer."

1.2 Potential Factors Affecting the Likelihood of Regional Conflicts

Different conflict obviously generates different kinds of manifestations but it is probably the methods of possible resolution that differ the most between international and intra-state conflict (Stockholm, 2005). The nature of local conflict at the regional (local/community) level also differs from developed to developing countries depending on the contextual setup. In developing countries, environmental problems are influenced by other issues such as social and economic concerns. Typically, these interests are related to socio-economic structure and conditions under which people live. Thus, these interests sometimes take priority over environmental concerns (Barbanti, 2004). The exact mechanisms by which these factors might affect the likelihoods of conflict escalating beyond a certain threshold may be complex and highly context specific, as may be the exact pathways toward resolution, stalemate, and escalation (Barron, 2004).There are different factors that could lead the society into conflicts. For example, economic shocks could lead individuals or groups of individuals to transgress on the property of others (e.g., through alleged livestock or petty theft), thereby serving as trigger for further conflict escalation. Out-migration may denote lack of economic opportunity within a village, or indirectly lead to a decline in local social capital as an individual invests less in community associations as they expect their future to be elsewhere (The World Bank Report, 2004).

Development related large-scale projects often concerns large scale population displacement which leads to a conflict. Assessments sponsored by the World Bank (1994) have estimated that every year since 1990, roughly 10 million people worldwide have been displaced by infrastructural development projects for a variety of reasons. In India alone, during the last 50 years, an estimated 25 million have been displaced by development projects. In that same period in China, development projects displaced more than 40 million people, including 13.6 million in

the 1990s. The following are the important causes or categories of development-induced displacement (Robinson, 2004):

Water supply (dams, reservoirs, irrigation)
Urban infrastructure
Transportation (roads, highways, canals)
Energy (mining, power plants, oil exploration and extraction, pipelines)
Agricultural expansion
Parks and forest reserves
Population redistribution schemes

Another potential area of conflict is natural resource management practice. Conflict over natural resources is a very common phenomenon across the world, particularly in the mountainous regions. For example the exploitation of mineral resources has a direct impact on the local environment. On the other side, the prospect of economic development of a local area by and large depends on the potential use of mineral resources. However, mining- and quarry-related issues also have a complex impact on economic, environmental and social factors. Property rights in the mining and forest areas are often ill defined which further triggers the conflict.

It is observed that most of the cases different development related projects start with the inadequate attention of possible dispute which many cases stimulate the local conflict. The integration of conflict reduction mechanism is still very weak in development and disaster risk management practices. The local institution and local leadership could provide the mechanism to resolve the conflict before it escalate. The social capital has a vital role in resolving such a regional conflict.

1.3 Objectives of Research

The main objectives of this research are to systematically model and analyze the processes of different regional conflicts under disaster and development, as well as to derive their policy implications. This study focuses on how stakeholders become empowered by other actors and grow as a complete player in a game, as implicitly assumed in the conventional game theory. Another focus is on the analysis of how cooperation could be possible where players are in a continuous process to redefine their game unless they find the most acceptable solution.

Three different case studies have been chosen for this research work, i.e., Rajaji National Park conflict (India), Chizu-Ichinose quarry conflict (Japan) and Yoshino River Weir conflict (Japan). In all the three cases, the confrontation evolved in the context of resource use, risk management and the development policy. These cross-cultural case studies give more analytical insights of knowledge development in the conflict resolution process which can be tested in the different parts of the world in similar situations. Table 1.1 shows the causes and consequences of these three different conflicts in a matrix form.

Table 1.1: Matrix of the Local level Conflict

			Hazardous Factors			
Location	Level	Type	Environmental	Social	Economic	Political
Rajaji National Park, India	Forest Community	Forced resettlement and livelihoods conflict	Environmental degradation due to over grazing and population pressure	Lack of property rights Low level literacy Lack of infrastructure Restriction of access to the local resources Insecurity	Poverty Dependency on animal husbandry	Power imbalance
Chizu-Ichinose, Tottori prefecture, Japan	Mountainous Community	Quarry conflict	Unscientific exploration of quarry by the local company Repeated landslide disasters			Lack of dialogue between the community and the local company
Yoshino River weir, Tokushima Prefecture, Japan	Community (upstream-mid stream and down stream)	Water resource and flood management conflict	The proposed new weir may not be effective for flood control Damage of water quality and ecosystem	Socially perceived risks are different in the upstream, mid stream and the down stream community	New weir may be costly	People movement against dam construction

1.4 Approaches to Conflict Analysis

There has been a remarkable shift of conflict and cooperation analysis in the last decade. The conflict and cooperation analysis started with Von Neumann and Morgenstern's (1944) pioneering theory on game. Game theory is widely used to understand the conflict and cooperation of players as an outcome of equilibrium. In classical game theory, players act rationally in the game and their preferences are fixed as it regarded as players' inherent and invariable properties. The structure of the game is fixed and there is nothing to do beyond the rules of the game. Due to its very strict assumption of the reality, the intellectual climate of game theory has moved more on to the behavioral aspects of decision making process where players no longer accept the payoff matrix as fixed. They try to change opponent's preferences through the threats and promises. Current thinking in the field of conflict is more psychology oriented rather than simply sociological or abstract mathematical. The territory of conflict is contributed by the sociologists, anthropologists, social psychologists and political scientists. For example the Marxist's class –struggle theory, which one loomed so large as to be identified in the minds of many as sociology itself, has long since ceased to invite the dedicated attention of conflict theorists (Bernard, 1965). As Lipset (1960) notes, "in every modern democracy conflict among different groups is expressed through political parties which basically represent a 'democratic translation of the class struggle'." The recent theories of conflict emphasize that it is a process and it involves the perceptions, thoughts, feelings and intentions of all parties. Pruitt and Rubin (1986) define conflict in a holistic way, as "a perceived divergence of interests, or a belief that the parties' current aspirations cannot be achieved simultaneously.''

There are different formal tools to model and analyze the conflict of interests and the possible solutions. Most of these methodologies have been derived from game theory, like Metagame theory (Howard, 1971), Conflict Analysis (Fraser and Hipel, 1984), Hypergame Analysis (Bennett, 1977, 1980; Wang *et al*., 1988), Graph Model For Conflict Resolution (Fang *et al.,* 1993), and Drama theory (Howard *et al.,* 1992, Bennet, and Howard, 1996; Howard, 1999; Bryant, 2003).

In this thesis the combined GMCR and drama theory methodologies is used to model and analyze

the real world conflicts. GMCR an ordinal preference based game theoretic approach is used to understand the strategic interaction and possible equilibrium of the game under different circumstances. GMCR defines outcome (states) first and strategies are determined as move between states. In GMCR analysis, choice is instrumentally rational within a fixed frame. Within such a fixed setup, players try to optimize their best outcome. This outcome can be equilibrium if it is stable for both the parties. On the other hand in drama theoretic approaches, player's choice is not instrumentally rational within a fixed frame of game. They start to redefine what they want and can do. Thus, starting from the assumption that characters try to be instrumentally rational within a fixed frame, drama theory shows how they are led to behave irrationally and to change the frame, so creating the possibility at rational behavior at a higher level (Howard, 2007). Combining two models may bring an effective methodological leverage to conflict and cooperation analysis.

1.5 Structure of Thesis

Based on the above discussions, structure of this research is designed as follows (Fig.1.1).

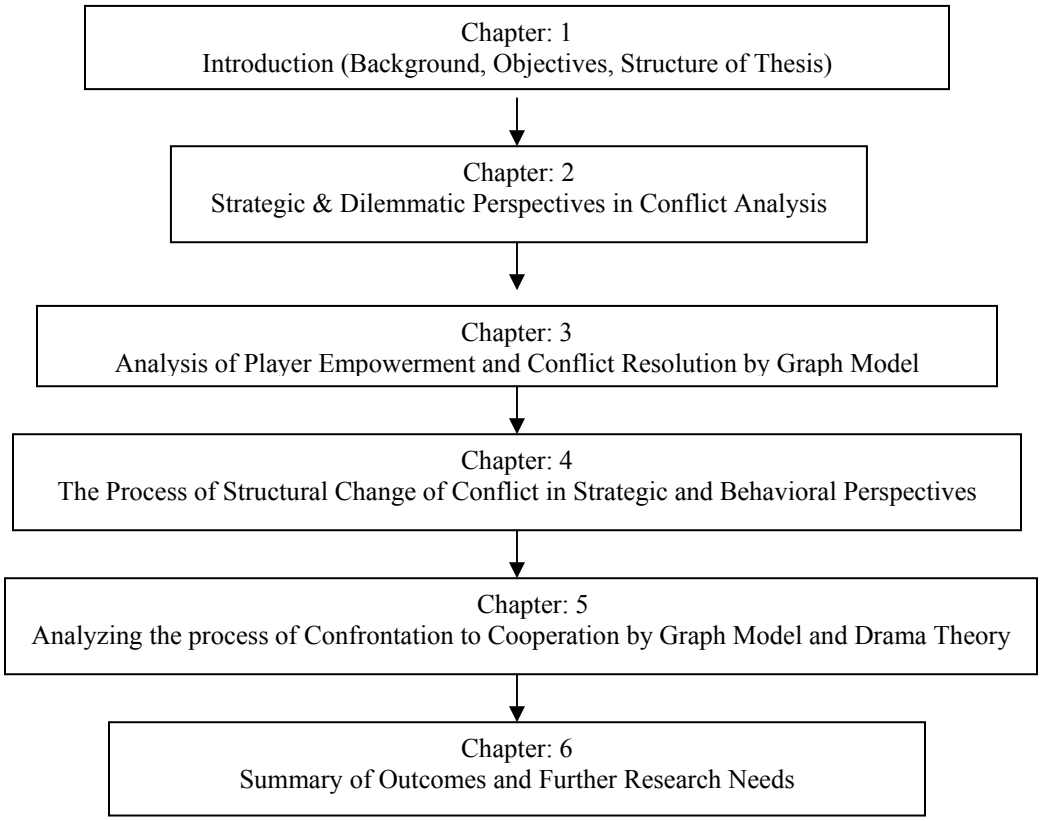

Fig. 1.1 Structure and contents of this thesis

Chapter 1 describes the overview and background of this research including the aim and the organization of the thesis.

Chapter 2 gives an overview of methodological approach in this research. Two complementary models i.e., GMCR and drama theory are used to bring effective methodological leverages of conflict and cooperation analysis.

Chapter 3 gives a framework to analyze the player empowerment in the conflict resolution process. It addresses the transformation process of stakeholders to become empowered by other actors and grow as a complete player in a game, as implicitly assumed in the conventional game theory. The analytical analysis has been carried out by using GMCR model. A case in point is made by extending the Battle of Sexes game for simplified illustration, and a real-world Rajaji National Park social conflict in India is analyzed to illustrate the empowering process of players.

Chapter 4 concentrates on analyzing player's strategic and behavioral aspects by using the combined GMCR (game theoretic approach) and drama theory (dilemma analysis) methodologies. These two models can be used in a complementary way. The combined methodology of conflict analysis is used to systematically describe the process of structural change of the conflict. The Chizu-Ichinose quarry conflict in Japan is used to illustrate this concept in the real world case which is seemingly resolved and then escalated.

Chapter 5 emphasizes to bring a new perspective of conflict and cooperation analysis in the Yoshino river weir conflict addressing combining game theoretic and drama theoretic approaches. The modeling and analysis of this case study shows how conflict can be resolved giving more emphasis on cooperation. In reference to this case study, it is shown how the players are in a continuous process to (de)construct their socially perceived reality in terms of changing their stands, beliefs and preferences. This also emphasizes that future can be created cooperatively by a group, rather than by way of confrontation in the conflict.

Chapter 6 summarizes the main contributions of the research and refers to the needs for further extensions of this research.

References

1) Barbanti, O, Jr. (2004): "Development, the environment and conflict," available on http://www.beyondintractability.org/action/essay.jsp?id=36049&nid=1165.
2) Bennett, P.G. (1980): "Hypergames: Development a model of conflicts", *Futures,* Vol.12, No. 6, pp.489-507.
3) Bennett, P.G., and Howard, N. (1996): "Rationality, emotion and preference change: Drama theoretic- models of choice," *Euro Jnl of OR*, Vol.92, No.3, pp. 603-614.
4) Bennett, P.G. (1977): "Towards a theory of hypergames", *Omega,* Vol. 5, No. 6, pp.749-751.
5) Bryant, J.W. (2006): "Drama theory: Dispelling the myths" *Journal of Operational Research Society,* pp. 1-12.
6) Bryant, J. (2003): *The Six Dilemmas of Collaboration: Inter Organizational Relationships as Drama*, Chichester, Wiley.
7) Bernard, J. (1965): "Some current conceptualizations in the field of conflict", *The American Journal of Sociology*, Vol.70, No.4, pp.442-454.
8) Fraser, N.M., and Hipel, K.W. (1984): *Conflict Analysis Models and Resolutions*, New York, NY: North – Holland.
9) Fang, L., Hipel., K.W., and Kilgour, D.M. (1993): *Interactive Decision Making – The Graph Model for Conflict Resolution,* Wiley New York.
10) Howard, N. (1971): *Paradoxes of Rationality*, MIT Press, Cambridge, MA.
11) Howard, N., Bennett, P.G., Bryant, J.W., and Bradley, M. (1992): "Manifesto for a theory of drama and irrational Choice", *Journal of Operational Research Society*, Vol. 44, pp.99-103.
12) Howard, N. (1994): "Drama theory and its relation to game theory", *Group Decision and Negotiation*, Vol.3, No.2, pp. 187-206 and 207-235.
13) Howard, N. (1999): *Confrontation Analysis: How to Win Operations rather than War*, CCRP, Department of Defense, Washigton, DC.
14) Howard, N. (2007): *Oedipus Decision Maker: Theory of Drama and Conflict Resolution*, available: http://www.dilemmasgalore.com.
15) Lipset, Martin. (1960): *Political Man*, New York: Doubleday & Co.
16) Miguel, E., Shankar, S, and Ernest, E. (2004). "Economic shocks and civil conflict: An instrumental variables approach," *Journal of Political Economy*, University of Chicago Press, Vol. 112(4), pp. 725-753.
17) Pruitt, D.G. and Rubin, J. Z. (1986): *Social Conflict: Escalation, Stalemate, and Settlement,* Random House Inc (T).
18) Robinson, W.C. (2004): "Minimizing development-induced displacement," available: http://www.migrationinformation.org/Feature/display.cfm?id=194.
19) Sensarma, S.R., Okada, N. (2006): "Conflict over natural resource exploitation in a mountainous community: The trade off between economic development and disaster risk mitigation --A case study," *Journal of Natural Disaster Science,* Vol.27, No. 2, pp. 95-100.
20) Stockhom, Sweden. (2005): Local conflict and water: Addressing conflicts in water projects, available: http://www.swedishwaterhouse.se/swh/resources/20051017114417Conflicts_Water_Projects_050823.pdf.
21) Von Neumann, J., and Morgenstern, O. (1944, 1953): *Theory of Games and Economic Behavior*, Princeton University Press, Princeton, New Jersey.
22) World Bank Environment Department (1994): *Resettlement and Development: The Bank Wide Review of Projects Involving Involuntary Resettlement*, 1986-1993. Washington, DC: World Bank.
23) Wisner, B. (2003): "Sustainable suffering? Reflections on development and disaster vulnerability in the post-Johannesburg world," *Regional Development Dialogue*, Vol. 24, No.1, pp. 135-148.
24) Wang, M., Hipel, K.W., and Fraser, N.M. (1998): "Modeling misperception in games", *Behavioral Science*, Vol. 33, No.3, pp.207-223.

CHAPTER 2: STRATEGIC & DILEMMATIC PERSPECTIVES TO CONFLICT ANALYSIS

2.1 Relevance of the Strategic and Dilemmatic Aspects to Conflict Analysis

Conflict can be apprehended as a potentiality or a situation, as a structure or a manifestation, as an event or process (Rummel, 1975). Okada and Sakakibara (2004) proposed to focus on 'scoping' as the dynamic process for changing structure of the conflict. The recent theories of conflict emphasize that it is a process and it involves the perceptions, thoughts, feelings and intentions of all parties. Pruitt and Rubin (1986) define conflict in a holistic way, "a perceived divergence of interests, or a belief that the parties' current aspirations cannot be achieved simultaneously.'' Most of the conflict resolution researches are based on rational choice theory. In game theoretic analysis choice is instrumentally rational within a fixed frame. Within such a fixed setup, there is nothing to do but try to guess what choice others will make and, given those choices, to optimize- i.e., try to get the outcome you most want (Howard, 2007). Rational choice theorists try to assume that people do this not only in games, but in life. The rules of the game are fixed here. It gives each player a fixed set of possible choices (sequential or simultaneous, continuous or discrete), says what outcomes (stochastic or deterministic) are expected from each mix of choices and fixes for each player and each payer of possible outcomes which of the pair that player should want (prefer). It is against the rules to change any of this (Howard, 2007). On the other hand drama theory deals with the peoples' emotional aspects of decision making process. Emotion makes the characters irrational. They start to redefine what they want and can do. Thus, starting from the assumption that characters try to be instrumentally rational within a fixed frame, drama theory shows how they are led to behave irrationally and to change the frame, so creating the possibility at rational behavior at a higher level (Howard, 2007). Irrationality can be captured logically in drama theory. Irrational behavior in drama theory is not an arbitrary. Bryant (2006) made a clear point to avoid the misunderstanding to use the notion of irrationality in drama theory. He stated, "In drama theory behavior is described as irrational if a person acts against his or her preferences. This contrast with the extreme game-theoretic position that choice reveals a person's preferences, a view that drama theorists maintain drains the term 'rationality' of any substance." In drama theory, the rules of the social game are not fixed. Characters (Players) are in a continuous process to (de)construct their socially perceived reality in a changing frame. Deridda (1976) proposes that deconstruction is as much concerned with the process and context of signification as the content that is signified, and provides a means of challenging what is constructed as real or self evident, or in the nature of the things. In drama theory, the frames of character's (player's) preferences are temporarily fixed in the episode. The continuous (de)construction process of character's (player's) stands, beliefs and preferences leads them to eliminate each of the paradoxes and to find a common interest gradient. Though the potential synergies of drama theory and (de)construction approach not yet explored so far.

Combining GMCR, a game theoretic approach and drama theory, a dilemma analysis approach can give a comprehensive picture of the conflict resolution process. GMCR modeling is taken as a base of this research. The different equilibrium concepts give different strategies to resolve the conflict. GMCR can give an indication that which equilibrium apparently has been reached. But it does not explicitly explain the structural changes of the conflict. This structural change is qualitatively interpreted in this thesis as the outcome of the intervening social shocks identified as a natural disaster impact, which may have been compounded by some political shift in the local government (Sensarma and Okada, 2006). Drama theory tries to catch the structural changes (emotion-caused sudden changes of the temporary frame) of the conflict in a dynamic process. Drama theory gives more focus on the player's position in the conflict which is somewhat

neglected in GMCR analysis. Positions are what characters (players) demanding, not what they are just prepared to accept (Bryant, 2006). Different possibilities of player's strategic moves in GMCR give insights in drama theory's character (player) to redefine their position to achieve the collaboration.

These two models can be used in a complementary way. The elimination of each dilemma may require a different tactics. The game theoretic orientation can give insights of strategic moves. All strategic moves – commitments, threats, and promises–must be credible (Dixit, 2006). This orientation helps drama theory to redefine the character's positions in respect of the threats and promises to achieve the collaboration in a dynamic process. Further drama theory can also capture the creeping metaphases of the conflict. Combining GMCR and drama theory approaches is intended to bring an effective methodological leverage in this thesis.

2.2 Strategic Analysis: Graph Model for Conflict Resolution

In 1940s, Von Neumann and Mogenstern developed game theory to explain the strategic interaction among different players. Game theory has found extensive applications to explain the conflict and predict the possible solution(s). But this theory has also the limitations in the real world applications, mainly due to its strong assumptions of the modeling conditions. In 1980s, Fraser and Hipel developed conflict analysis model to overcome some difficulties in traditional game theoretic analysis and further they extended this model as the Graph Model for Conflict Resolution (GMCR). In this model, instead of cardinal utility, the decision maker's ordinal preference can be ranked from most preferred to least preferred. The model assumes that all preferences are transitive. It gives analytical insight into problems within which possible strategic interaction among the decision makers (DMs) can be systematically analyzed in order to ascertain possible compromise resolutions, or equilibria. But this approach also assumes that players are rational and their preferences are fixed. This approach allows different kinds of equilibria under different circumstances.

2.2.1 Basic Components

GMCRII provides a simple strategic representation of conflict, with minimal information requirements that can be analyzed for a range of stability patterns that represent different styles of decision making in a real-world conflict (Fig. 2.1).This is founded upon a mathematical framework utilizing concepts from graph theory, set theory and logical reasoning. It represents a conflict as moving from one state to another state (the vertices of a graph) via transmissions (the arcs of the graph) controlled by the decision makers. Mathematically, this Let $N = \{1, 2, \ldots, n\}$ be the set of players and $K = \{K_1, K_2, \ldots, K_u\}$ be the set of states of the conflict, and n-tuple $\{D_i\}$ (i=1, 2…, n) be the set of directed graphs where $D_i = (K, V_i)$. Set of arcs V_i means player i's possible move between states. Let $k_l k_m$ be the arc from state k_l to state k_m. If, $k_l k_m \in V_i$ it implies that player i can move from state k_l to state k_m unilaterally. Payoff function P_i specifies player i's preference order for states. If $P_i(k_l) > P_i(k_m)$, player i prefers state k_l to state k_m. The Graph Model for Conflict Resolution (GMCR) is presented by 4-tuple $\{N, K, V, P\}$, where $N = \{1, 2, \ldots, n\}$, $K = \{1, 2, \ldots, k\}$, $V = \{V_1, V_2, \ldots, V_n\}$ and. $P = P_i / i \in N\}$.

One advantage of the graph model over more traditional game theoretical approaches is that it can represent irreversible moves. In such cases, a decision maker can unilaterally move from state k to state q but not from q to k. Preferences in graph model are expressed in terms of pair of binary relations $\{\succ i, \sim i\}$ on S ,where $s_1 \succ s_2$ indicates that player i prefers s_1 to s_2, and $s_1 \sim s_2$ means that player i is indifferent between s_1 and s_2 (or equally prefers s_1 and s_2). Three subsets of the state S are defined as:

$\Phi_i^+(s) = \{s_m: s_m \succ_i s\}$;all states that player *i* prefers to *s*.

$\Phi_i^-(s) = \{s_m: s \succ_i s_m\}$;all states that player *i* prefers less than state *s*.

$\Phi_i^{\equiv}(s) = \{s_m: s_m \sim_i s\}$; all states are indifferent to *s* for player *i*.

In the graph model, player *i*'s reachability list $R_i(s)$ from a given state *s*, contains all states that player *i* can move to in one step. $R_i(s)$ can be partitioned into three subsets using the above mentioned subsets of the state *S*:

$R_i^+(s) = R_i(s) \cap \Phi_i^+(s)$; all unilateral improvements from state *s* for player *i*.

$R_i^-(s) = R_i(s) \cap \Phi_i^-(s)$; all unilateral disimprovements from state *s* for player *i*.

$R_i^{\equiv}(s) = R_i(s) \cap \Phi_i^{\equiv}(s)$; all equally preferred states reachable from state *s* by player *i*.

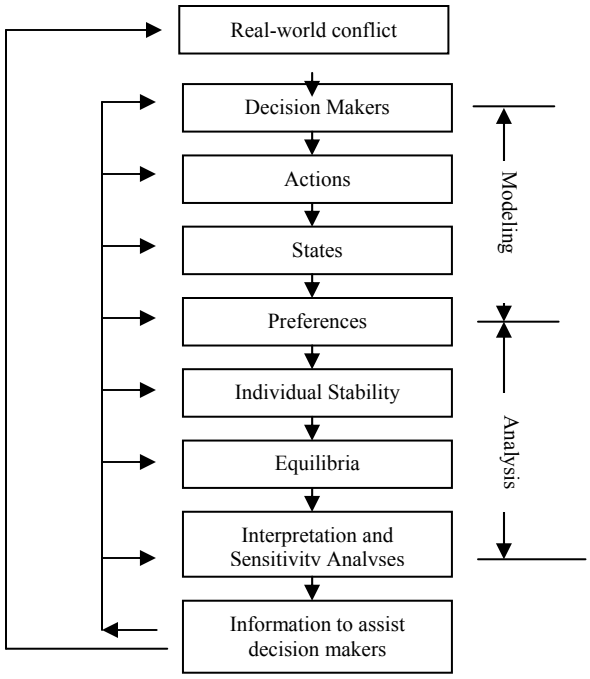

Fig. 2.1 Applying the Graph Model for Conflict Resolution
(After, Fang *et al.,* 1993)

2.2.2 Stability Analysis

When a player does not have an incentive to move from a particular state, the state is called stable for the player, and the state is called equilibrium if it is stable for all the players.
$G = (S, (A_i: i \in N))$ ..... (1)

The main stability definitions currently used in graph model analysis include Nash Stability (Nash), General Metarationality (GMR), Symmetric Metarationality (SMR), Sequential Stability (SEQ), Limited Move Stability (L_h), and Non-Myopic Stability (NM) (Kilgour *et al.,* 2005).

Table 2.1 describes some features of these definitions that relate them to behavior in conflicts. Foresight, for example, refers to the maximum number of moves foreseen by a DM whose stability calculation follows a particular definition. Disimprovement refers to the tendency of a DM to a less preferred state in order to reach a more preferred state eventually, or to block

unilateral improvements of other DMs. The knowledge of preferences refers to the amount of information available to a DM about its own and others' relative preferences over states. The strategic risk refers to the attitude of decision maker towards taking the risk. According to Kilgour *et al*. (2001), "different stability concepts may give rise to different equilibria, and in principle each decision maker may be of a different stability type."

Table 2.1 Solution Concepts and Human Behavior

Solution concepts & References	Foresight	Disimprovements	Knowledge of preferences	Strategic Risk	Stability descriptions
Nash Stability *Nash (1950,1951)*	Low	Never	Own	Ignore risk	Decision makers (DM) can not move unilaterally to a more preferred state.
General Metarationality *Howard (1971)*	Medium	By opponents	Own	Avoid risk; conservative	All of the focal DM's unilaterally improvements are sanctioned by subsequent unilateral moves by others.
Symmetric Metarationality *Howard (1971)*	Medium	By opponents	Own	Avoid risk; conservative	All focal DM's unilateral improvements are still sanctioned even after possible responses by the focal DM.
Sequential Stability *Fraser and Hipel (1979,1984)*	Medium	Never	All	Take some risks; strategies	All of the focal DM's unilaterally improvements are sanctioned by subsequent unilateral improvements by others.
Limited move Stability *Kigour (1985);Kilgour, Hipel ,and Fang (1987):Zagare (1984)*	variable	Strategic	All	Accepts risk; strategies	All DM's are assumed to act optimally and a maximum number of state transitions (*h*) are specified.
Non myopic Stability *Brams and Wittman(1981):Kilgour(1984, 1985);Kilgour, Hipel and Fang (1987)*	High	Strategic	All	Accepts risk; strategies	Limiting case of limited move stability as the maximum number of state transitions increases to infinity.

Source: Hipel *et al.,* 2002

2.2.3 Notion of Stability Definition in GMCR

Nash Stability

State *k* is the Nash stable for player *i* iff *i* cannot improve his payoff by changing his own stategies. In other words,

$S_i^+(k) = \{\varnothing\}$ .....(2)

Under Nash Stability, player *i* expects that player *j* will stay at any state *i* moves to, and consequently that any state *i* moves to will be the final state. The initial state *k* is therefore stable iff *i* cannot move from *k* to any state *i* prefers.

General Metarationality

State *k* is general metaratinal for player *i* iff for every $k_1 \in S_i^+(k)$, there exists at least one

$k_2 \in S_j^+(k_1)$ with $P_i(k_2) \leq P_i(k)$ ..... (3)

Player *i* expects that player *j*, *i*'s opponent, will respond by hurting *i* if it is possible for *j* to do so, so that *k* is stable iff *j* can hurt *i* if *i* takes any unilateral improvement. Note that *i* anticipates that the conflict will end after *j*'s move, and that *j*'s move (called a "sanction") will be chosen without regard to *j*'s payoffs.

Symmetric Metarationality

State *k* is symmetric metarational for player *i* iff for every, $k_1 \in S_i^+(k)$ there exists, $k_2 \in S_j^+(k_1)$,

such that $P_i(k_2) \leq P_i(k)$ and $P_i(k_3) \leq P_i(k)$ for all $k_3 \in S_i(k_2)$ ..... (4)

Symmetric metarationality is like to general metarationality except that player *i* expects to have a chance to counter respond (k_3) to *j*'s response (k_2) to *i*'s original move (k_1). Note that *i* anticipates that the conflict will end after his counterresponse, and that *j*'s response will be chosen both to hurt *i* and to make any counter response by *i* profitless, but again without to *j*'s payoffs.

Sequential Stability
State *k* is sequentially stable for player *i* iff for every $k_1 \in S_i^+(k)$, there exists $k_2 \in S_j^+(k_1)$ with $P_i(k) \geq P_i(k_2)$ ..... (5)
This stability condition is similar to general metarationality, but includes only those sanctions (k_2) that are "credible" [$k_2 \in S_j^+(k_1)$ is required, rather than merely $k_2 \in S_j(k_1)$].

Limited move Stability
State *k* is limited –move, horizon *h*, stable (L_h) for player *i* iff $G_h(i,k)=k$. ..... (6)
If it is assumed that original player cannot take part in the sanctioning process, and hence counter respond, then one is restricted to lengths $h \leq 2$. However, any non negative integer *h* may serve as the length if the original player may reenter that move-countermove sequence.

Non myopic Stability
State *k* is nonmyopic ally stable for player *i* iff there is a positive integer *t*' such that $G_t(i,k)=k$ for all $t \geq t'$…… (7)
Non myopic Stability is the limiting case of limited move stability as the horizon *h* increased without bound.

The relationship of different stability concepts are shown in Fig. 2.2.

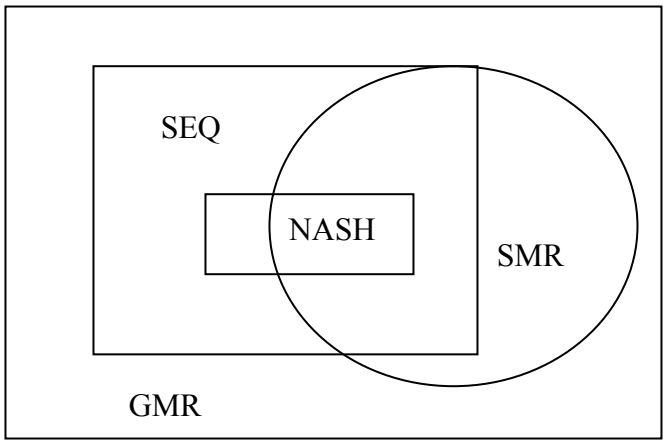

Fig. 2.2 Stability relationships in GMCR
(Fraser *et al.*, 1984)

2.3 Behavioral Perspectives: Drama Theory

Generally game theory assumes that structure of the conflict is strict, player cannot change their preferences. But this orthodox assumption has a great limitation when it comes to the question of implementation. This rigid assumption is criticized by many scholars. For example, game theory has been recast by Schelling (1980) refereeing the concept of coordination game based on tactic communication and strategic moves. The classical game theory ignores what is happening around. But the surrounding environment has a great impact to change the player's inherent preferences and stability. Picard (1999) argued that "stability measures involve many considerations (e.g., economic, political and military), many players (a situations that's stable for one player may not be able for another) and should be capable of adapting to change over time (a situation that's stable today may not be stable tomorrow)".

To overcome this problem drama theory comes up with a new notion where players (characters) no longer accept the payoff matrix as fixed. Characters communicate each others and redefine their game in terms of either changing their strategy or try to change opponents' options and preferences. Emotion plays a vital role to deconstruct player's subjective reality in their objective frame. Drama theory gives more focus on player's behavioral aspects of interaction in a dynamic process. This also emphasizes that future can be created cooperatively by a group, rather than placing emphasis on conflict. This is the fundamental aspect of drama theory.

2.3.1 Basic Notion of Drama Theory

To overcome the limitations of 'rational choice model', Howard (1992) postulated a new decision model called drama theory incorporating 'non rational' aspects of decision making process such as crisis, emotion, and self realization. Drama theory is further developed by Howard *et al.*, 1992; Bennet, and Howard, 1996; Howard, 1999; Bryant, 2003.This approach addresses how players (characters) apply rational emotional- pressure on each other to redefine the game prior to it being played (Stubbs *et al.*, 1999). The fundamental difference between game theory and drama theory is that a drama allows for the possibility of the game itself changing even though the environment remains informationally closed; that is, it considers the possibility of endogenous changes, arising from interactions within the game itself (Howard, 1994). Game theoretic players become drama theoretic characters, and an outcome as a scenario. Preferences remain intact (Tait, 1997) and this makes a frame, scene at a particular point. Characters interact through a series of episodes. A dramatic episode is an interaction between parties in which a set of issues is at stake. It ends when some of the issues are decided, so that there is now a new set of issues (Howard, 2007). Character's choices influence the outcome of each particular episode, and also what episodes happen next. Within each episode, there are notions of scene setting, buildup, climax and denouement, a structure repeated on a large scale for the drama as a whole (Fig. 2.3). In buildup stage, characters communicate, each pressing for a particular position-a scenario that they wish to have created and in the climax of the episode, the frames themselves come under pressure. The 'moment of truth' occurs, in a drama-theoretic model, at the end of the build up and they move on to the climax. When players are in confrontational mode, a moment of truth is defied as a triple (F,p,f) , where $F = (h, >)$ is a frame (the common reference frame), $p = (p^c | c \in C)$is a family of positions, one for each character in the cast C, and f is the fallback (Jones *et al.,* 2001). The paradoxes of rationality create specific forms of emotion and preference change, as well as generation of new options, involvement of other characters etc. The characters then take actions that move them onto another episode.

2.3.2 Confrontation Analysis: Dilemma Elimination

Howard, Bennett, Bryant and Bradley (1992) developed a technique to analyze conflict and cooperation to solve the real world problems which is called Confrontation Analysis. This is also called Dilemma Analysis. This is derived from drama theory. This technique allows card table model to analyze the conflict. A card table model of moment of truth consists of:

I. A set of characters, each holding a number of cards (A filled in shape signifies that the character has taken this option and empty shapes means that character has not accept this options and '—'represents either/ or – the option may or may not be adopted.)
II. For each of the character has a position. This is a specification of each card (that belongs to all the characters) if it should be played nor not played.
III. Fall back positions / threatened future. (A character's fallback consists of the cards it is threatening to play if its position is not accepted. The character may not intend to carry out its threat; that is, it may be bluffing. In any case threatened future is the scenario that would result from implementation of everyone's declared fallback (Bryant, 2007).

Fig. 2.4 illustrates the components of Card Table Model (Options Board).

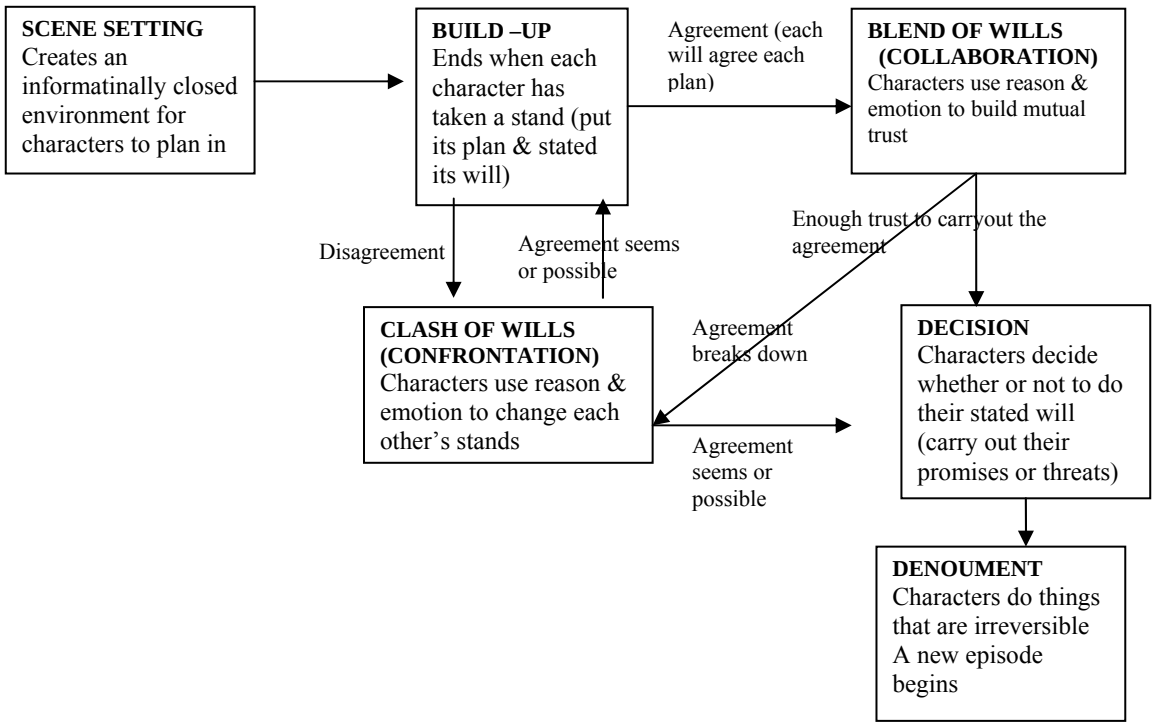

Fig. 2.3 Six Phases of confrontation
(Howard, 2007)

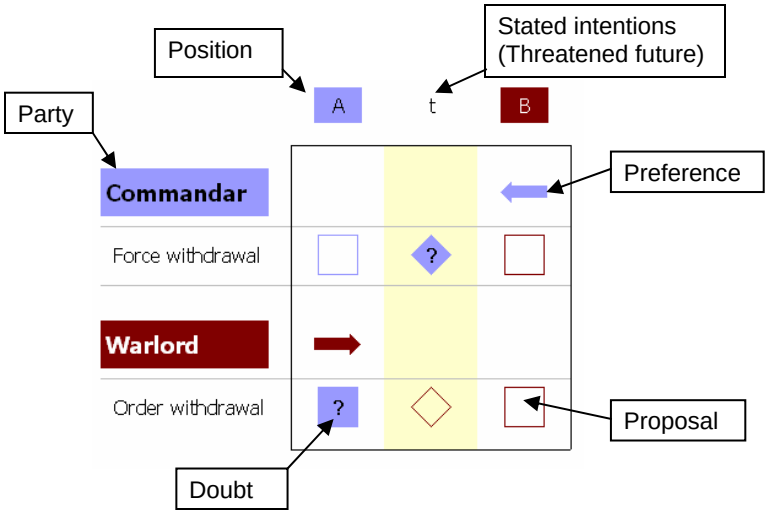

Fig. 2.4 Components of an Options Board
(Tait, 2005)

Howard (1994) mentioned that there are only six dilemmas that the character faces during the confrontation phase. Two kinds of basic distinctions are made between the dilemmas of confrontation and collaboration. The first kind is relevant only when characters are in

confrontation mode, i.e., when their positions are incompatible. The second is the case with dilemmas of collaboration, which is important preliminarily in collaboration mode; they are only relevant in confrontation mode insofar as confronting characters look forward to the fact that, if a certain poison is accepted, they will have to deal with it in collaboration mode. The dilemmas that character A may face with respect to another character B at a moment of truth are as follows (Table 2.2, Fig. 2.5). In drama theory, character faces a dilemma when their threats and promises are incredible. Dilemmas can be delineated if the characters change their position. Threats and promises that really matter are those that support or undermine character's position (Bennett, 1997).When none of the dilemmas exist, then the characters reach an agreement to carryout their promises. From this point there are no potential improvements for them. This is called the 'strong equilibrium' in drama theory.

Table 2.2 Six Drama theoretic Dilemmas

A's Cooperation dilemma: B does not believe A would carry out its actual or putative promise to implement B's position.
A's Trust dilemma: A does not believe B would carry out its actual or putative promise to implement A's position.
A's Persuasion (also known as Deterrence) dilemma: B certainly prefers the threatened future to A's position.
A's Rejection (also known as Inducement) dilemma: A may prefer B's position to the threatened future.
A's Threat dilemma: B does not believe A would carry out its threat not to implement B's position.
A's Positioning dilemma: A prefers B's position to its own, but rejects it (usually because it considers it unrealistic).

Source: http://en.wikipedia.org/wiki/Drama_Theory

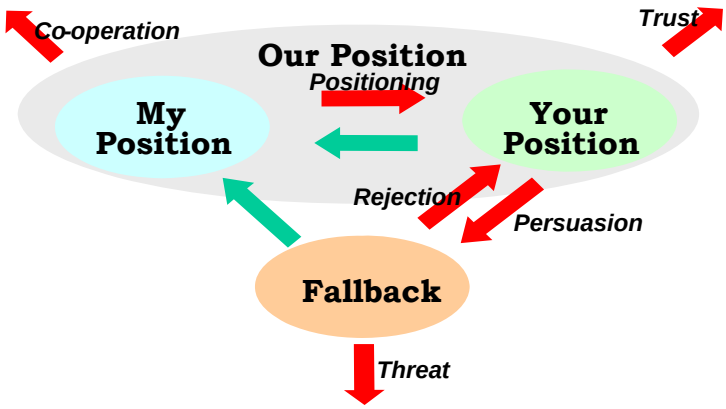

Fig. 2.5 Dilemmas in drama theory
(Bryant, 2003)

2.3.3 Mathematical Definition of Dilemmas

The mathematical foundation of drama theory has been developed by Howard and Jones (1998), and Howard (2001). Instead of analyzing a game-type model for 'solutions', confrontation analyses it for 'dilemmas' (Howard *et al.,* 2001).

Dilemmas of confrontation

Threat Dilemma

The threat dilemma is a dilemma of implementation. A character facing this dilemma might not implement the fall back strategy (or 'threat') it is committed to. The threat gradient for character *c* ,ThGrad(*c*), contains all potential improvements for *c* from the fallback future, i.,e, all potential improvements for the one person group containing *c*. Thus it is,

ThGrad(*c*) =Imp $_{\{c\}}$ ($\{f\}$)

$=\{s \in S\text{-}\{f\} \mid s_{C\text{-}\{c\}} = f_{C\text{-}\{c\}};\ s \geq_c f\}$ …… (8)

If this set is non-empty, it would be rational for *c,* if negotiations break down and it expects the others to implement $f_{C\text{-}\{c\}}$, not to implement its fallback strategy $f_{\{c\}}$ but to implement a different strategy $S_{\{c\}}$. We say that *c*'s fallback is incredible that *c* is blustering.

The threatened future *f* is incredible; that is, *f* will be called incredible if

$\cup(\text{ThGrad}(c) \mid c \in C) = \cup(\text{Imp}_{\{c\}}(\{f\}) \mid c \in C) \neq \emptyset$…….. (9)

In words, *f* is incredible if the union of all threat gradients, which is the same as the set of individual potential improvements from *f*, is non empty.

Persuasion dilemma

The persuasion dilemma is a dilemma of communication. The persuasion gradient for *c,* , contains all characters incompatible with *c* that prefer the threatened future to any of *c*'s proposals. Thus it is,

$\text{DeGrad}(c) = \{b \in C \mid p^c \cap p^b = \emptyset;\ \forall\, s \in p^c f >_b s\}$…… (10)

If *c* has a persuasion dilemma with respect to *b* (i.e., if $b \in$DeGrad(*c*), *c* is said to be unrealistic toward *b*; the threatened future places no pressure on *b* to accept *c*'s position. Hence, if *c* is to be taken seriously it must change either its position, the preferences of those in its gradient, or the threatened future.

Rejection dilemma

The rejection dilemma is again a dilemma of communication. The rejection gradient for *c* contains all characters incompatible with *c* that offer proposals as good for *c* as the threatened future *f*. Thus it is,

$\text{InGrad}(c) = \{b \in C \mid p^c \cap p^b = \emptyset;\ \exists s \in p^b : s \geq_c f$....(11)

If this were non-empty, it would be rational for *c* to accept *b*'s proposals, rather than reject it and suffer *f*; yet *c* is insisting it won't do that. We say that *c* is obdurate toward *b*.

Positioning dilemma

The positioning dilemma is another dilemma of communication. The positioning gradient for *c* contains all characters whose positions contain proposals better for *c* than some future belonging to its own position p^c. Thus it is,

$\text{PoGrad}(c) = \{b \in C \mid p^c \cap p^b = \emptyset;\ \exists s \in p^b,\ t \in p^c :\ s >_c t\}$…… (12)

If *c* has a positioning dilemma in relation to *b*, *c* rejects *b*'s position, yet prefers a proposal of *b*'s to some proposal of its own. This makes it hard for *c* to sustain its rejection, or to argue that *b* should give in and accept *c*'s own position. We say that *c* is inconsistent toward *b*.

Dilemmas of collaboration

Co-operation dilemma

The co-operation dilemma, like the threat dilemma, is a dilemma of implementation. A character faces this dilemma when others might not be able to trust it to implement its part of it own position, should they agree to it. The co-operation gradient for character *c* contains all potential improvements from *c*'s position for groups containing *c*. Thus it is,

$\text{CoGrad}(c) = \cup \{\text{Imp}_G(p^c) \mid c \in G \subseteq C\}$

$= \{s \notin p^c \mid \exists\, t \in p^c : \exists G \ni c : s_{-G=} t_{-G;}\ s \geq_G t$.....(13)

If this is empty, *c* is said to be trustworthy. Otherwise, *c* is untrustworthy in relation to at least one of its proposals, *t,* in that *c* is open to persuasion by the group *G* (which may contain just *c* itself) to 'defect' from *t* to a point outside p^c.

Trust dilemma

The trust dilemma is again a dilemma of implementation. A character faces this dilemma when it might not be able to trust others to implement their part of its position, even if they agreed to it. The trust gradient for *c* is,

TrGrad $(c) = \cup\ (\text{Imp}_G(p^c) \mid c \notin G)$

$= \{s \notin p^c \mid \exists\, t \in p^c : \exists G : c \notin G; s_{-G} = t_{-G;}\ s \geq_G t\}$ ……(14)

If this set is empty, *c* is said to be trusting. Otherwise, it has to be mistrusting in relation to at least one of its own proposals, *t*, as group *G* not containing *c* would be tempted to defect from *t* to a selection not in p^c.

2.3.4 Strict, strong equilibrium

Given a selection *s* and a group *G*, write S_G for the sub selection of card selected, within *s,* by members of *G*. That is, write, for any *s* and *G*:

$$S_{G = S \cap h^* G} \ldots\ldots \quad (15)$$

A set *x* of selections as a strict , strong equilibrium if it is co-ordinated and no group *G* has a potential improvement from it- where the set $\text{Imp}_G(x)$ of potential improvements for *G* from *x* is defined by,

$$\text{Imp}_G(x) = \{s \in S\text{-}x \mid \exists\, t \in x : s_{-G} = t_{-G;}\ s \geq_G t\} \ldots\ldots \quad (16)$$

(Note that, '*-G'* for the group *C-G-i.e.,* the set of characters in the cast *C* that are not in group *G.*)

Thus, a potential improvement from *x* is a selection outside *x* to which a group *G* can move 'unilaterally' (i.e., given that those not in *G* do not change their selections) from a selection inside *x* without any member of *G* losing utility from the move. Accordingly, a strict, strong equilibrium will be a co-ordinated set of selections such that no group *G* can move unilaterally, from a selection in it to a selection outside it without loss to some member. Hence, if all characters in the cast *C* agree to implement a non-empty, strict , strong equilibrium *x*, each individual or group within *C* must mean and is able to do so (i.e., can be trusted not to break the agreement).

2.4 Conclusions

As mentioned in the beginning of this chapter that GMCR approach helps to structure the conflict and gives the strategic insight of the process as move of different players in a state transition graph. GMCR can capture the static snapshots of the whole process where player's options and preferences are fixed. On the other hand, drama theory shows how the confrontation evolved over time and the characters engage in confrontation and keep changing their positions, preferences and perceptions through interactions with others. As compared to game theoretic solution, drama theory puts its emphasis on psychological behavior of players' (characters) interaction process to achieve the collaboration. The combined game theoretic and drama theoretic models give more insight in the evolution of the conflict. As Bryant (2006) mentioned, "Drama theory could explain the pressures felt and imposed by all parties to achieve a meaningful agreement and a fair basis for contribution: game theory might be used to understand why such an agreement had apparently

been reached, one party then failed to deliver what it had offered. So, in this sense drama theory and game theory are complementary, each dealing with a distinct part of the overall process."

References

1) Bennett, P.G., and Howard, N. (1996): "Rationality, emotion and preference change: Drama theoretic-models of choice," *Euro Jnl. of OR,* pp. 603-614.
2) Bennett, P, Howard, N., and Bryant, J. (2001): "Drama theory and confrontation analysis", in Rosenhead, J., and Mingers, J. (eds): *Rational Analysis For a Problematic World Revisited*, Wiley ,Chichester, pp.225-248.
3) Bryant, J.W. (2006): "Drama theory: Dispelling the myths" *Journal of Operational Research Society,* pp. 1-12.
4) Bryant, J.W. (1998): "Analyzing collaboration as drama", *System Practice and Action Research,* Vol.11, No. 4.
5) Bryant, J.W. (2003): *The Six Dilemmas of Collaboration: Inter Organizational Relationships as Drama*, Chichester, Wiley.
6) Crowe M., Carlyle D. (2003): "Deconstructing risk assessment and management in mental health nursing", *Journal of Advanced Nursing,* Vol. 43, No. 1, July, pp. 19-27.
7) Dixit, A. (2006): "Thomas Schelling's contributions to game theory," *Scand. J. of Economics,* Vol.108, No. 2, pp.213-219.
8) Derrida, J. (1976, corrected edn. 1997): *On Grammatology*, Spivak, G.C., (Translator), John Hopkins University, Baltrimore.
9) Fraser, N.M., and Hipel, K.W. (1984): *Conflict Analysis Models and Resolutions*, New York, NY: North – Holland.
10) Fang, L., Hipel, K.W., and Kilgour, D.M. (1993): *Interactive Decision Making -The Graph Model for Conflict Resolution*, Wiley New York.
11) Howard, N., Bennett, P.G., Bryant, J.W., and Bradley, M. (1992): "Manifesto for a theory of drama and irrational choice", *Journal of Operational Research Society*, Vol.44, pp.99-103.
12) Howard, N. (1994):"Drama theory and its relation to game theory", *Group Decision and Negotiation,* Vol. 3, pp. 187-206 and 207-235.
13) Howard, N. (1971): *Paradoxes of Rationality*, MIT Press, Cambridge, MA.
14) Howard, N. (2007): *Oedipus Decision Maker: Theory of Drama and Conflict Resolution,* available: http://www.dilemmasgalore.com.
15) Howard, N. (1998): "N-person 'soft' games", *Journal of Operation Research Society,* Vol. 49, pp. 144-150.
16) Howard, N. (1999): *Confrontation Analysis: How to Win Operations rather than War*, CCRP, Department of defense, Washigton, DC.
17) http://en.wikipedia.org/wiki/Drama_Theory
18) Kilgour, D. Marc.,and Hipel, K. W.(2005) : "The Graph Model for Conflict Resolution: Past, present and future," *Group Decision and Negotiation,* Vol. 14, No. 6, pp. 441 – 460.
19) Murray-Jones, P., and Howard. N. (2001): "Co-coordinated Positions in a drama –theoretic confrontation: Mathematical foundations for a PO decision support system'', *CCRTS Symposium.*
20) Nash, J.F. (1950): "Equilibrium points in *n*-persons games," *Proc. Nat. Acad. Sci.,* Vol.36, pp. 48-49.
21) Okada, N., and Sakakibara, H. (2004): "Conflict Management as a part of integrated disaster risk management – Issues, socio-cultural contexts, and methodological leverages", *Proceedings of the IEEE International Conference on Systems, Man, and Cybernetics*.
22) Picard, R., Graves, T., and Booker, J. (1999): "Stability modeling and game-theoretic considerations," *Los Alamos National Laboratory Technical Report,* LA-UR-99-5360, available: http://www.au.af.mil/au/awc/awcgate/gaming/stable-lanl-gov.pdf.
23) Rummel, R. J. (1975): *Understanding Conflict and War*, Sage Publication, New York.
24) Schelling, T. (1980): *The Strategy of Conflict*, Harvard University Press.
25) Stubbs, L., Tait, A., Howard, N. (1999). "How to model a confrontation - Computer support for drama theory." *Proceedings of the 1999 Command and Control Research and Technology Symposium*, Naval War College, Newport.
26) Sensarma, S.R., and Okada, N. (2006): "Analysis of the Chizu-Ichinose community disaster mitigation conflict: The process matters," *Infrastructure Planning Review, Japan Society For*

*Civil Engineers***,** Vol.23, No. 4, pp. 299-308.
27) Tait, A. (1997): "Drama without tears," *Operational Research Society Tutorial Papers*, YOR10.
28) Tait, A. (2005): Modeling confrontations using option board, available : http://www.andrewtait.com/papers/usingoptionsboards.pdf
29) Von Neumann,J., and Mogenstern ,O. (1944, 1953): *Theory of Games and Economic Behavior,* Princeton University press, Princeton.

CHAPTER 3: ANALYSIS OF PLAYER EMPOWERMENT AND CONFLICT RESOLUTION BY GRAPH MODEL*

3.1 Introduction

The aim of this chapter is to propose the transformation process of stakeholders to become empowered by other actors and grow as a complete player in a game, as implicitly assumed in the conventional game theory. The conventional game theory implicitly assumes players to be complete in terms of three capacities i.e., representability, knowledge, and executability. However in the real world, all the players are not always complete players. Representability describes the possibilities to depict player's own preferences in a game. Common knowledge refers if all of the players know it (it is mutual knowledge) and all of the players know that the other players all know it, and that they know that all other players know that all other players know it, and so on. Another kind of knowledge is an external knowledge, which does not belong to the concerned players, but if an external actor provides the concerned players with some external knowledge that was not perceived and owned by the players, it becomes a shared knowledge. Executability refers to some capacity to transfer player's strategies into action. Without the knowledge and representability the player cannot achieve the executability of the strategy.

Depending on the extent to which these capacities are fulfilled by the players, it is proposed to systematically categorize the capacity status of a player, e.g., 'null player,' 'intermediate player' and 'complete player' in a game. Thus a game theoretic approach is used to examine how player's status affects the structure of the game and subsequently their strategic choices.

The formation of preferences and player's strategies is modeled in a game theoretic form in conjunction with social network approach. It has also shown that so far; more attention has to be paid to this kind of social network approach, and its strategy evolution in a game theoretic domain. Thus another aim is to enhancing awareness producing a prototype method for highlighting this unexplored research. As Skyrms and Pemantle (2000) argued that, "the idea of simultaneous evolution of strategy and social network appears to be almost completely unexplored."

(Somewhat differently in the context of cooperative game, Hart defines the null player such that, "a player i is a null player in (N,v) if $v(S\cup\{i\})=v(S)$ for all S ". The axiom states that if i is a null player in (N,v) then $\varphi^i(N,v)=0$.) Here a null player is defined in a non-cooperative game as one lacking representability, complete knowledge and executability in the game. Null players cannot move unilaterally. They are forced to move along with their opponent players only. They have to see the game precisely to totally accept (mirror) their opponent's preference. A null player can become empowered to become an intermediate or complete player if he/she receives some complementary competence from a supportive actor. If the null player can obtain representability, and common knowledge with the rest of the players, he/she will become an intermediate player.

* Sensarma, S.R, and Okada, N. (2007a): "Game theoretic analysis of the process of player empowerment in resolving social conflict", *IEEE International Conference on Systems, Man, and Cybernetics, Montreal, Canada* (in print).
Sensarma, S.R, and Okada, N. (2007b): "Social conflict over displacement, resource rights and survival risk: A case study of Rajaji National Park, India", *Annuals of Disas. Prev. Res. Inst.*, Kyoto Univ. (in print).

But to become a complete player, he/she needs the capacity to execute his/her representative moves.

Here it is noted that actors are differentiated from players. An actor can be defined as an external stakeholder who can participate in the game only from outside and indirectly. Actors are, however, not players who can play the game openly. They serve to upgrade the status of a null player to become an intermediate and finally a complete player in terms of enhancing their representability capacity and common knowledge. The executability can also be provided by an actor with authority to do so.

A case in point is made by extending the Battle of Sexes game for simplified illustration, and a real-world Rajaji National Park social conflict in India is analyzed to illustrate the empowering process of players (Sensarma, and Okada, 2007a, and b).

3.2 Empowering Player Capacity

As mentioned above, the conventional game presumes that players have the three main characteristics, i.e., representability, knowledge, and executability to play the game. However, in many real life situations all the stake holders (or 'would be players') in a game may not always possess all of the mentioned capacities. Players can become empowered by the help of an external actor(s) capitalizing on their respective social networks. In order to analyze this process, we may go backward when at least one of the players in the game is a null player. It is argued that there are the three stages of interactive decision making situations, i.e., (a) Initial stage: In this stage at least one of the players is a null player, (b) Intermediate stage: In this stage, null player becomes empowered by an other external actor(s) to gain the knowledge and representability capacities, and (c) Complete game stage: In this stage, an intermediate player becomes a complete player which means he/she has complete knowledge, representability and executability to play the real game.

3.3 Battle of Sexes Game

This problem can be analyzed using the well-known Battle of Sexes coordination game. In this game, the husband wants to go the prize fight, does not want to go to the ballet, but prefers to go to the ballet with his wife than going alone to the prize fight. On the other hand, the wife prefers ballet over the prize fight, but would rather go the prize fight with her husband than to the ballet by herself. This is a two-person co-ordinated game with conflicting preferences. This can be represented by the GMCR where, 'Y' means 'Yes' and indicates that the option is taken for a corresponding state, and 'N' means 'No', where the option is not taken (Table 3.1). Mathematically, there are a total of 16 (2^4=16) possible states, but after removing all infeasible states, there are 4 feasible states in total (Table 3.1). Some states are infeasible because they are mutually exclusive. Here two Nash equilibria exist, that is state 1, and 4 where both the husband and the wife either can go to the prize fight or the ballet together. This is a game with complete information, in that their preferences and payoff structures are common knowledge and the players are all complete as game theory ideally assumes. In the next section, this game is modified in the different stages.

Table 3.1 Feasible States of the Standard BOS Game

Options \ States		1	2	3	4
Husband	Go to the prize fight	Y	N	Y	N
	Go to the ballet	N	Y	N	Y
Wife	Go to the prize fight	Y	Y	N	N
	Go to the ballet	N	N	Y	Y

3.3.1 Modified Battle of Sexes Game

(a) Initial stage: Suppose, in the modified Battle of Sexes game, the wife has no car license. Thus she cannot go alone to a place of far distance. She also lacks knowledge of her husband's preferences. Her move is nullified. So, she has no choice but to move along with her husband. Due to lack of knowledge, representability and executability, wife follows the game by simply accepting (mirroring) her husband's preference. Thus, apparently only equilibrium, i.e., state 1 is possible. (b) Intermediate stage: This stage can be reached if the wife can get support from the outside actor who is not directly involved in this game, but can help to enhance her capacity. For example, imagine such a situation that the wife lacks knowledge of her husband's preferences, so that it is difficult for her to play the game. To play the game she needs at least to share the knowledge and to own her representability capacity. However, if the knowledge is provided by (an) external actor(s), the wife can now become an intermediate player. Suppose, after their communication, wife and husband are ready to share their evening in a common place, she thus possesses the representability capacity. Whereas earlier she only had one-way move, she now has more reachability from one state to another. Table 3.2 shows the resultantly changed reachable lists and payoff structures of the players. The same is shown graphically in Fig. 3.1 where a one-way arrow shows the one-way move and the two-way arrow shows the both way move. It can be interpreted that after becoming an intermediate player the wife has the ability to move and countermove in this game. But the wife is yet not able to execute her move. (c) Complete game stage: To execute her move, she needs to reach the place. Due to some trouble, say, some parking problem, husband wants to avoid the car. Now it assumes here that such an option like public transport is available to both, they can go either to the prize fight or to the ballet. This scenario is the same as shown in the standard Battle of Sexes game.

Table 3.2 Reachable Lists and Payoffs of Players in the Modified BOS Game

States	Husband		Wife		
K	$S_1(k)$	$P_1(k)$	$S_2(k)$ not as a complete player	$S_2(k)$ as an intermediate/ complete player	$P_2(k)$
1	2	4	Ø	3	3
2	1	1	Ø	4	1
3	4	2	1	1	2
4	3	3	2	2	4

* Note: K= State number; $S_i(k)$ = Reachable list for player i from state k; $Pi(K)$ = Payoff of player i for state k.

Another scenario is that an external actor can also bring in a new option which may be preferred by both of them, and this way the wife can also be empowered. Supposing a new option of "go to a restaurant" can also change the structure of the game. Assume also that the availability

of such a new option is common knowledge, and both can also represent this particular option by having each preference represented in his/her payoffs. By assumption, the new option is preferred by both of them, and they can execute the game together by using the public transportation. In this game there are 9 feasible states (Table 3.3). The three Nash equilibria exist in this game, state 1, 5, and 9. In the equilibrium 1, both can go to the prize flight, in the case of 5, both can go to the ballet and in the equilibrium 9, both can go to the restaurant. Thus the unperceived option provided as common knowledge by the external actor can help the wife to further enhance her capacity. This brings the new perspective of the structure of the game. Table 3.4 shows the reachable lists and payoff structures and Fig. 3.2 shows the players' moves in the state transition graph.

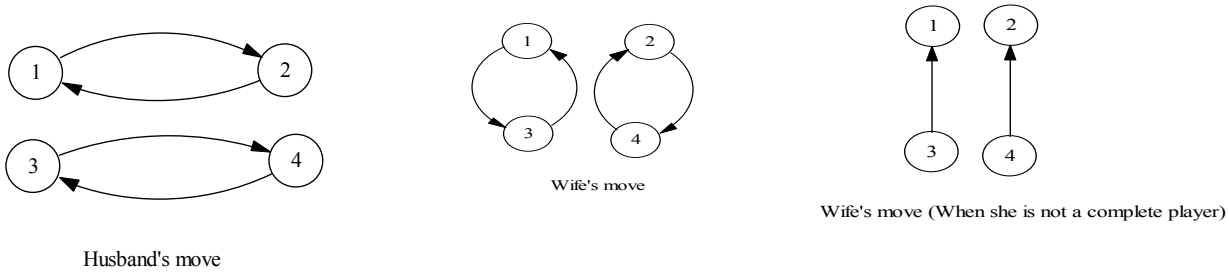

Fig. 3.1 State transition graph in the BOS game

Table 3.3 Feasible States of the BOS Game With External Option

Options \ States		1	2	3	4	5	6	7	8	9
Husband	Go to the prize fight	Y	N	N	Y	N	N	Y	N	N
	Go to the ballet	N	Y	N	N	Y	N	N	Y	N
	Go to the restaurant	N	N	Y	N	N	Y	N	N	Y
Wife	Go to the prize fight	Y	Y	Y	N	N	N	N	N	N
	Go to the ballet	N	N	N	Y	Y	Y	N	N	N
	Go to the restaurant	N	N	N	N	N	N	Y	Y	Y

Table 3.4 Reachable Lists and Payoffs of Players in Modified BOS Game With External Option

	Husband		Wife	
K	$S_1(k)$	$P_1(k)$	$S_2(k)$	$P_2(k)$
1	2,3	9	4,7	9
2	1,3	8	5,8	8
3	1,2	1	6,9	7
4	5,6	8	1,7	8
5	4,6	9	2,8	9
6	4,5	7	3,9	1
7	8,9	2	1,4	7
8	7,9	7	2,5	2
9	7,8	9	3,6	9

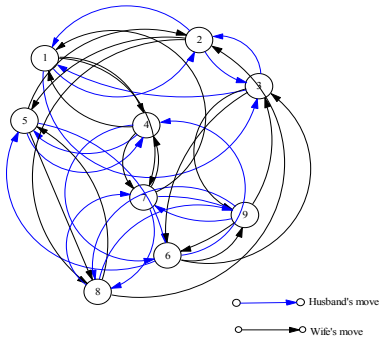

Fig. 3.2 Players' move in state transition graph (Modified BOS game with external option)

3.4 Rajaji National Park- A Real World Social Conflict

3.4.1 Introduction

Concerning the idea of 'wilderness to be conserved' along with the Malthusian theory of population explosion, and Hardin's 'Tragedy of Commons', in 1989, Ives and Messserli postulated their hypothesis, i.e., 'Perceived Himalayan Crisis' which has been widely applied in policy making concerning the hill and forest area in India. In this related context there are two distinct discourses in the forest policy. When local people are seen as basically destructive to their environment, the environment in question should preferably be managed by an outside agent, say for example the State government representing forest officials and wildlife wardens, this type of approach as 'governance discourse'. Conversely, if local people with local knowledge are considered to be using their environment with care (if given the chance), and therefore the protected areas are expected to be best managed by the forest dwellers themselves. This approach can be seen as 'people oriented discourse'. More realistically, the negotiating outcome would be preferably a joint venture coordinated between the Forest Department and the local forest dwellers to collaboratively manage the forest. This approach can be called 'participatory discourse' in the resource management.

3.4.2 Background of the Conflict

The proposed Rajaji national park comprises 825 sq. km of land, situated in the Shiwalik hills, and is representative of Shiwalik ecosystem which lies between the Himalaya and the upper Gangetic plains (Fig. 3.3). The park is known as an ecologically sensitive area and is the habitat of many endemic plant species, and also forms the North-West most range of the asiatic elephants. The Van Gujjars are the pastoral nomads who have lived for centuries in deras, large thatched circular huts, throughout much of the park area as well as in the Shiwalik forest division to the west. The majorities of the Van Gujjars either migrate to the mountains for the summer and monsoon seasons or move to the shorter distances out of the park. Basically their livelihoods are based on raising buffaloes and selling milk. They utilize the forest fodder to their animals. In the periphery of the forest, the local villagers' livelihood is also based on the local resources. The confrontation arose in 1983, when the Rajaji area was declared as a proposed national park. The real conflict is centered around forcible displacement of forest-based families from their traditional habitat and disruption of their livelihoods. The major claim made by the State government is to clear the national park area from encroachment. The chronology of the conflict is described here in different time periods in Table 3.5. The information is synthesized from many sources like the reports (RLEK, 1997; IPT, 2002; Gooch, 1998), news paper articles and the field interview with the stakeholders.

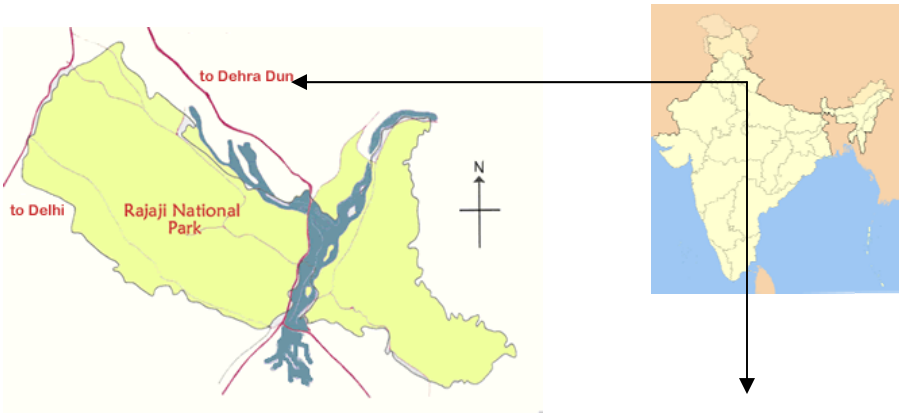

Fig. 3.3 Location of the Rajaji National Park

Table 3.5 Chronology of the Conflict

Year	Events
	Phase I
1983	Within the notification of the proposed Rajaji national park in 1983 and on the basis of Wildlife Protection Act, 1972, the Forest Department forced the Van Gujjars to move from the core of the forest in order to protect the fragile ecosystem.
1985	Pathri Gujjar colony was constructed by the Uttar Pradesh Government.
1986	The GKMM (Ghad Kshetra Mukti Morcha), a local NGO has been involved with several issues at the village level including the land rights, grazing rights, corruption in government departments, oppression of women, education.
1988	In view of the Honorable Supreme court order efforts were made for rehabilitant Gujjar families outside of the Rajaji National Park at Pathri. As a result, in 1988, 62 families selected their houses at Gujjar colony.
1989	In January 1989, the Van Gujjars filed a write petition in Hon'ble supreme court of India in which they opposed rehabilitation outside of the Rajaji National Park.
1991	In 1991, several rounds of meeting were held with the Forest Department to try and resolve the crisis of access to bhabar grass.
1992	The conflict had escalated in the September when the Forest Department forced the Van Gujjars to move from the park.
	The Van Gujjars brought the details of the case to the notice of the RLEK, a Dehradun based NGO.
1993	After the UN declaration, the Van Gujjars' conflict became a territory of national and global interests.
	The IPT (People's Tribunal on Environment and Human Rights) report declared on 22nd April, which recommended setup a multi-stakeholder platform to reduce the conflict.
1995	GKMSS has kept up the pressure on the Forest Department to find a suitable way to meet local resource requirements. In May 1995 the State responded by issuing an unprecedented order which has provided much hope in the region.
	The Forest Department succeeds in coaxing 65 Gujjar families to move to the Pathri rehabilitated colony.
	Phase II
1996	The issue attends the interest of, among others, a BBC film team as well as team from large German magazine Stern.
	The Wild Life Institute of India had launched a project called 'Building Partnerships For Biodiversity Conservation in RNP' with the help of Ford Foundation, an international donor agent, and continued till March 2000. This project has provided to create a participatory platform where all the stakeholders can share their views.
	In February, RLEK organized a national consultancy workshop and they presented the plan 'Community Forest Management in Protected Areas: Van Gujjars-proposal for the Rajaji Area' with the close collaboration with the Van Gujjars and the peripheral forest dwellers.
	In September, some of the Van Gujjars' representatives met the U.S. representative from the World Bank at a workshop in Delhi to discuss the eco-development project being jointly funded by the Global Environmental Facility (GEF) and the World Bank for some Indian national parks. This meeting was later presented in the Indian media as ''probably the first time World Bank sat down at the negotiation table directly with Indian forest dwellers.''
	The people of the villages took decision of the possibility of establishing resource utilization forest committees through their several public meetings.
1998	Gujjars through RLEK went to the Human Rights Commission and alleged the human rights violation against them inside the RNP.
	A fresh census of Gujjars' families was carried out in which 1390 Van Gujjars were identified in side the RNP. A fresh rehabilitation scheme was prepared for them.

	The Human rights commission vide their consent order dated 15/03/99 passed the certain orders. The crux issues were,Van Gujjars living inside the forest cannot be denied the rights which they have been enjoying since time immortal viz. right to lop and right to graze their cattle**.** The forest authorities are not entitled to coerce the Van Gujjar families to move out their habitation until their rights are legally determined in accordance with the law.
2000	On May 11, the Rajaji area came under the jurisdiction of newly formed State Uttaranchal formerly Uttar Pradesh.
	On September 30, Ministry of Environment and Forest (Central Government) again requested State/UT government to consider the settlement order issued on 18th September, 1990 and to setup commission/comities at the District levels involving Revenue, Forest and Tribal Welfare departments for the settlement of the disputed claims of tribal and forest dwellers.
2004	Another rehabilitation colony, Gandikatha, a few kilometers away from the park was built to rehabilitate 778 Gujjar families. But only 255 families moved and others opposed to move in this new location.
2005	Van Gujjars filed a write petition to the Lokayukta to take the further action for the rehabilitation issue and their rights of local resources.
2006	Van Gujjars had complained to the Uttaranchal Lokayukta against the move by the State government to forcibly evict the nomadic community despite earlier orders by the National Human Rights Commission (NHRC).
	The Forest Rights bill passed.

3.4.3 First Phase of the Conflict (1983-1995)

3.4.3.1 Initial Stage

In the beginning of the conflict, the Van Gujjars and the peripheral forest dwellers were not able to represent their utility. They were the null players in this conflict. As a complete player, the Forest Department had the full capacity to play the game. The players were not interacting (connected) to each others and thus the null graph evolved with no vertices and no edges in the initial confrontation phase. Fig. 3.4 represents the null space of this confrontation discourse. Table 3.5 shows the options available to the players during this phase. Here, the Van Gujjars and the peripheral forest dwellers cannot move unilaterally from state *k* to state *q a*nd their common move is also nullified.

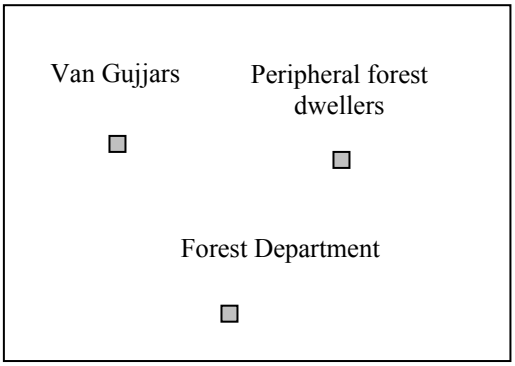

Fig. 3.4 Null graph in the initial stage

3.4.3.2 Intermediate Stage

In 1992, the conflict had escalated during in the spring (September) when some of the Van Gujjars returned from their annual migration they were stopped by the Park authorities (Forest Department) at the boundary of the national park and asked to move the Pathri resettlement colony and also those Van Gujjars who were staying in the park area had been forced by the

Forest Department to put their thump print on a piece of paper saying that they would not be allowed back in to the forest when they retuned in autumn. The Van Gujjars brought the details of the case to the notice of the RLEK, a Dehradun based NGO who organized the first meeting of the Van Gujjars to protest this incident. Since then this NGO had started different development projects in cooperation with the Van Gujjars to strengthen their pastoral life and overall welfare. Another organization GKMM had been involved with several issues in the peripheral level, especially those involving *dalits*[*] and other backward classes, including land rights, grazing rights, corruption in government departments, oppression of women, education, but the ban worker issue has always been a primary one for the organization. Obviously the turn of the conflict was due to the emergence of actors supporting the former null players the Van Gujjars and the peripheral forest dwellers. The actual game started when the null players begin to interact with the other actors. These interactions are modeled as games. The payoff represents the stakeholder's up gradation to become a player. The RLEK Serves to the Van Gujjars and the GKMM serves to the peripheral forest dwellers to become a player. Thus social network evolved through the involvement of different actors limited to different players, their strategy and link with others (Fig.3.5). The knowledge is provided by the external actors and consequently the Gujjars and the peripheral forest dwellers are able to represent their preferences due to the complements from their supportive actors, i.e., RLEK and the GKMM.

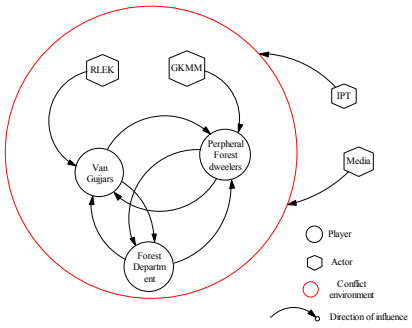

Fig. 3.5 Social network in the intermediate stage (Phase I)

The conflict is modeled as 3 players, i.e., the Van Gujjars, the peripheral forest dwellers and the Forest Department. In this stage, every one is connected interacting as a decision maker with others and they have the following options: Opposing the rehabilitation (Van Gujjars), claiming the resource rights (Peripheral forest dwellers), rehabilitating the Gujjars, and opposing the resource rights (Forest Department) (Table 3.6). Mathematically there are total 18 (2^4 =18) possible states, but after removing all the infeasible states there are 9 feasible states in total (Table 3.7). Some states are infeasible because they are mutually exclusive. The number is reduced substantially by removing the infeasible states. In the Tables 3.6 and 3.7, 'Y' means 'Yes' and indicates that the option is taken for a corresponding state, and 'N' means 'No', that the option is not taken. Given this set of preferences, states 4, 6, 8 and 9 are the possible equilibria in this game. In equilibrium 4, both the Gujjars and the peripheral forest dwellers would be better off. Note that the status quo state was unstable in this phase. Table 3.8 shows the reachability and the payoff functions of the players. The Van Gujjars and the peripheral forest dwellers reachability and payoffs represent the joint involvement with the supportive actor(s). Fig.3.6 shows the possible

[*] *In the Indian caste system, a Dalit, often called an untouchable, or an outcaste, is a person who according to traditional Hindu belief does not have any "varnas".*

moves of the players in this phase in a state transition graph. It represents players' possible strategies in a game.

Table 3.6 Players and their Options (Phase I)

Players and their options	Status Quo State
Van Gujjars	
1. Opposing the rehabilitation	Y
Peripheral forest dwellers	
2. Claiming the resource rights	Y
Forest Department	
3. Rehabilitating the Gujjars	Y
4. Opposing the resource rights	Y

Table 3.7 Feasible States of the Conflict (Phase I)

States / Options		1	2	3	4	5	6	7	8	9
Van Gujjars	1	N	Y	N	Y	N	N	N	Y	N
Peripheral forest dwellers	2	N	N	Y	Y	N	Y	N	N	N
Forest Department	3	N	N	N	N	Y	Y	N	N	Y
	4	N	N	N	N	N	N	Y	Y	Y

In 1995, the IPT requested the former justice Mr. Poti to visit the Rajaji National Park, where a series of consultation meetings were held with representatives of the local communities, NGOs, the (former) field director of Rajaji and the other Forest Department officials, the Wild Life Institute of India and other organizations. Following the initiative the interim report was released by the IPT on April 22, 1995. The major focus of the IPT report was on the process of combining conservation with meeting local people needs, including the creation of a multi-agency team to plan and manage the park. The IPT's role was more like a catalyst to reinforce the conflict to move on to a negotiation stage, i.e., phase II. Media also played a vital role to open up this discourse to a large public. A Swedish researcher wrote, media representations of the Van Gujjars pastoralists and the conflict over Rajaji has consequently been very important in changing the public image from one at the beginning of the conflict, where they were pictured as 'destroyer' of their forest environment to one which gained in importance during time, where they are seen as 'saviors' of the very same environment.

Table 3. 8 Reachibility Lists and Payoff Functions (Phase I: Intermediate Stage)

	Van Gujjars		Peripheral forest dwellers		Forest Department	
K	$S_1(k)$	$P_1(k)$	$S_2(k)$	$P_2(k)$	$S_3(k)$	$P_3(k)$
1	2	5	3	5	5,7,9	4
2	1	8	4	6	8	2
3	4	6	1	8	6	3
4	3	9	2	9	Ø	1
5	Ø	2	6	4	1,7,9	8
6	Ø	3	5	7	3	7
7	8	4	Ø	2	1,5,9	6
8	7	7	Ø	3	2	5
9	Ø	1	Ø	1	1,5,7	9

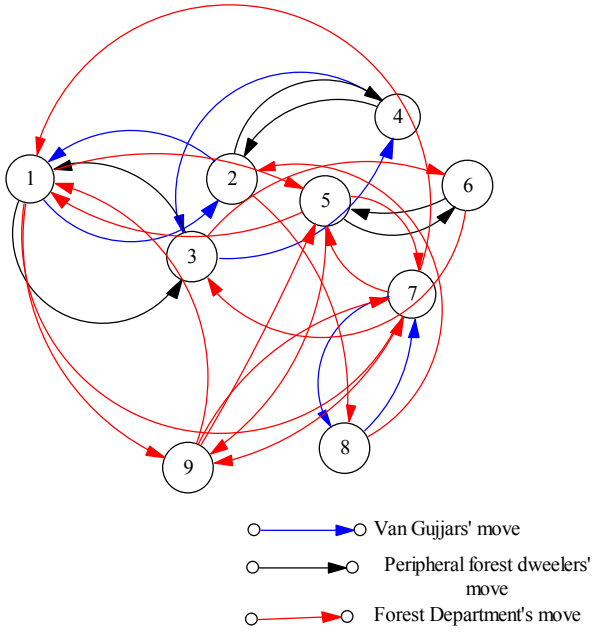

Fig. 3.6 State transition graph (Phase I-Intermediate stage)

3.4.4 Second Phase of the Conflict (1996-2006)

3.4.4.1 Intermediate to Complete Game Stage

In the third stage of the conflict (Second Phase), many national and international actors took their respective roles. As an effort of IPT, in 1996, the WII launched a project called 'Building Partnerships for Biodiversity Conservation in RNP' with the help of an international donor agent, 'Ford foundation' and this continued till March 2000. This project provided to create a participatory platform where all the stakeholders were able to share their views. Another major initiative was taken by the Van Gujjars in 1998. Through RLEK, they went to the Human Rights Commission and alleged the human rights violation against them inside the RNP. The issue attended the interest of media, like the newspapers, a BBC film team as well as a team from large German magazine Stern. In this way the images of Gujjars become more global even if the people themselves stayed in a forest.

The game is modeled incorporating the same players as noted in the first phase of the conflict but their options and preferences have changed from the previous period due to the other actors' compliments. Now the Van Gujjars have several options available which strengthen their survival issue. The Forest Department has also shifted their preferences to the resource rights negotiation issue with the peripheral forest dwellers. There are a total six options available to the players. These are, staying in the park, appealing to the NHRC, making a proposal for CFMP (Van Gujjars), exercising the rights of natural resources (Peripheral forest dwellers), and rehabilitating the Gujjars, negotiating with the peripheral forest dwellers (Forest Department) (Table 3.9). There are potentially 18 feasible distinct states to consider in this conflict. However some of the states are mutually exclusive or option dependent which subsequently reduces the number of feasible sates (Table 3.10). Like the Van Gujjars stay in the park and the Forest Department rehabilitates them, both are mutually exclusive. The state 17 is a strong equilibrium under all the stability concepts and the state 5 is stable under GMR and SMR stability concepts , and 11 is

stable under GMR, SMR and SEQ concepts. The equilibrium 17 represents the negotiation scenario among the players which partly took place during this period.

Table 3.9 Players and their Options (Phase II)

Players and their options	Status Quo State
Van Gujjars	
1. Staying in the park	Y
2. Appealing to the NHRC	Y
3. Making a proposal for CFMP	Y
Peripheral forest dwellers	
4. Exercising the rights of natural resources	Y
Forest Department	
5. Rehabilitating the Gujjars	Y
6. Negotiating with the peripheral forest dwellers	Y

Table 3.10 Feasible States of the Conflict in Phase II

States / Options		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Van Gujjars	1	N	Y	Y	Y	Y	N	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	N
	2	N	N	Y	N	Y	N	N	Y	N	Y	N	N	N	N	Y	N	Y	N
	3	N	N	N	Y	Y	N	N	N	Y	Y	N	N	N	N	N	Y	Y	N
Peripheral forest dweelers	4	N	N	N	N	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
Forest Department	5	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	Y
	6	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y

Many international actors played their perspective roles as a supporter, facilitator, donor, mediator, and arbitrator and thus the network has expanded with the new strategies and options (Fig.3.7). It can be interpreted that the NHRC's role was an arbitrator who could reduce the outcomes and it restrict the player's action. They excluded outcome 11, from this game, where the Forest Department can rehabilaite the Van Gujjars from the park. The WII with the support of a donor agent has influenced the decision makers' actual state of ranking in this mediation process. But it was project based mediation for a stipulated time. Within this time, many conflicts had been resolved and a participatory platform evolved as a result of this mediation. The players coping capacity also enhanced and trust building among the stakeholders was another achievement in this mediation process (Bhardwaj, 2002). As an intermediate player the Van Gujjars and the peripheral forest dwellers along with their supportive players have common moves in this game. In this phase, the Van Gujjars have more options due to the external actor's complementary competence. For example, alone they are not able to appeal to the NHRC (National Human Rights Commission). The proposal for community forest management is also only possible due to the RLEK intervenes. The peripheral forest dwellers' option is also shifted from claiming rights to the exercising rights due to constant efforts from the GKMM side. Thus players' representability and knowledge enhanced as a process of network formation in a game. Table 3.11 shows different reachability and payoff functions in this negotiation phase. Fig. 3.8 represents the possible move of the players in the state transition graph which is enhanced by the external actor's intervenes.

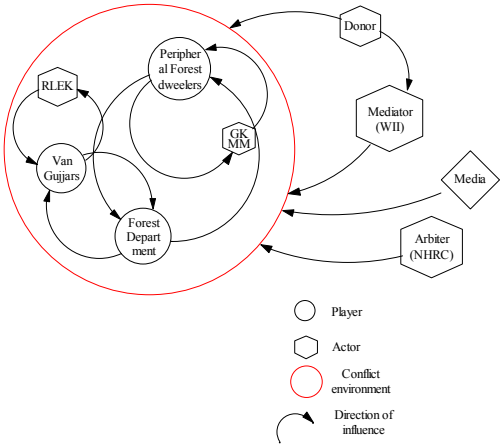

Fig. 3.7 Social network in the intermediate to complete game stage (Phase II)

In 2006, the Forest Rights Bill passed which further strengthened the Van Gujjars and the peripheral forest dweller's survival issue. Several meetings were held at the national level where not only the Gujjars and the forest dwellers currently from the RNP took part in these meetings but several forest dwellers from the other places also participated. In this way, they are in the process of forming a network at different levels incorporating different actors to whom they are directly or indirectly linked. In this process the Van Gujjars and the peripheral forest dwellers were empowered by the external actors to become complete players in this ongoing game.

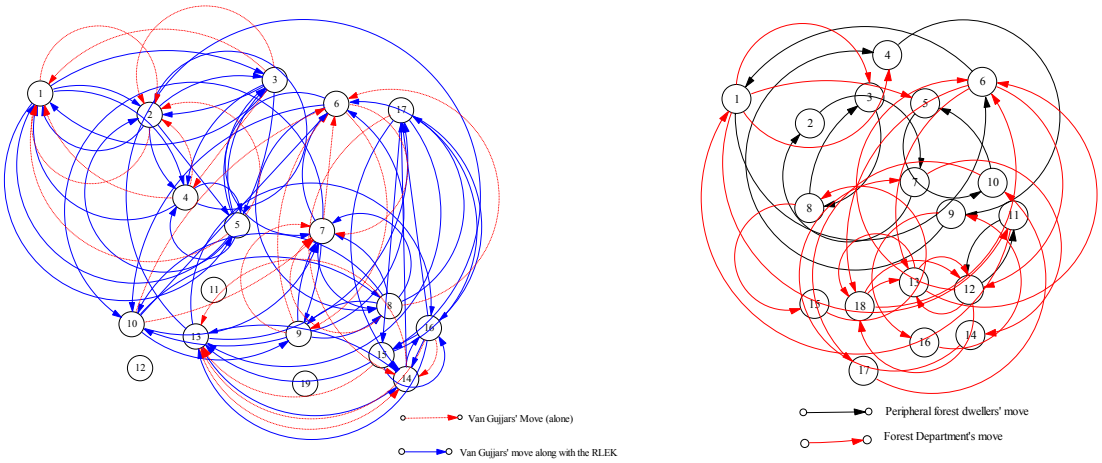

Fig. 3.8 State transition graph (Phase II- Intermediate to complete game stage)

Table 3.11 Reachable Lists and Payoffs: RNP Conflict (Phase II: Intermediate to complete game stage)

State	Van Gujjars	Van Gujjars along with the supportive actor		Peripheral forest dwellers along with the supportive actor		Forest Department	
K	$S_1(k)$	$S_1(k)$	$P_1(k)$	$S_2(k)$	$P_2(k)$	$S_3(k)$	$P_3(k)$
1	2	2,3,4,5	4	6	3	11,3,4,5	12
2	1	1,3,4,5	7	7	5	Ø	9
3	1,2,4	1,2,4,5	13	8	4	Ø	5
4	1,2	1,2,3,5	10	9	6	Ø	3
5	1,2	1,2,3,4	16	10	7	Ø	7
6	7	7,8,9,10	5	1	8	12,13,18	1
7	6	6,8,9,10	8	2	11	14	13
8	6,7	6,7,9,10	14	3	13	15	10
9	6,7	6,7,8,10	11	4	12	16	6
10	6,7	6,7,8,9	17	5	14	17	4
11	Ø	Ø	1	12	15	1	8
12	Ø	Ø	2	11	16	6,13,18	2
13	14	14,15,16,17	6	Ø	1	6,12,18	17
14	13	13,15,16,17	9	Ø	2	7	15
15	13	13,14,16,17	15	Ø	9	8	18
16	13,14	13,14,15,17	12	Ø	10	9	16
17	13,14	13,14,15,16	18	Ø	17	10	14
18	Ø	Ø	3	Ø	18	6,12,13	11

3.5 Complementary Analysis and Insights

Here, an attempt has been made to categorize the player's capacity status and to analyze the process of capacity building over a period of time in a game implicitly attained by the respective social networks joined by the actors. Based on the field visits in Rajaji National Park area, it is found that State government did underestimate the possible risks of forced resettlement policy. The creation of national park without sustainable livelihoods alternative to the Van Gujjars and peripheral forest dwellers ultimately leads to a win-lose situation. This modeling and analysis shows that the forced displacement and disruption of forest people livelihoods cannot be a sustainable solution in park management policy.

3.6 Conclusions

The above proposed concept is examined in both abstract and real world conflict cases. The modified BOS game shows that the game basically depends on a player's capacity to play the game. The game with incomplete players may mislead the equilibrium concept. In the Battle of Sexes game and a real world Rajaji National Park conflict case, it is examined how the players are eventually empowered by an external actor(s). The game can start only when the players are able to participate in the discourse. But to participate they should have knowledge, representability and executability which are often missing in a real world case. The different phases of the conflict and negotiation are discussed here, including the initial stage (where some players are null), the initial confrontation phase (a null player becomes an intermediate player), and the complete game phase (player may be intermediate or complete) .The evolution of player's

strategy in a game in conjunction with social network approach is analyzed by using GMCR model, which may give methodological development of GMCR model.

References

1) Ahuja, S.P. (1981): "A Socio-Economic study of the Gujjars," Centre for Planning and Action, New Delhi, *Unpublished Mimeo.*
2) Anon (1973): *Management Plan for Rajjaji Sanctuary* (1973-74 to 1982-83).
3) Bhardwaj, A. K, Baroda, R., and Misra, B.K. (2002): "Building partnerships for biodiversity conservation- A collaborative project with Ford Foundation in Rajaji National Park",*Wildlife Institute of India.*
4) Badola, R. (19980): "Attitudes of local people towards conservation and alternatives to forest resources: A case study from the lower Himalayas," *Biodiversity and Conservation,* Vol. 7, pp.1245-1259.
5) Dogra, B. (2004): Parks and people save Wildlife but do not displace People, published *by Dogra, B., C-27, Rakkshakunj Paschim Vihar, New Delhi* 110063.
6) Fraser, N.M., and Hipel, K.W. (1984): *Conflict Analysis Models and Resolutions,* New York, NY: North – Holland.
7) Gooch, P. (1998): *At the Tail of the Buffalo; Van Gujjar Pastoralists between the Forest and the World Arena,* Department of Sociology, Lund University.
8) Game theory.net: Common knowledge, available: http://www.gametheory.net/Dictionary/CommonKnowledge.html.
9) Hardin, G. (1968): "The tragedy of the commons", Science, Vol. 162, No. 3859, pp. 1243-1248.
10) Hart, S. "Classical cooperative theory II: value-like concepts", available: http://www.ma.huji.ac.il/~hart/papers/value-lk.pdf.
11) IPT (2002): ''Preliminary Report on the Rajaji National Park",avialble: http://www.iptindia.org/pdf/Rajaji.pdf.
12) Ives, Jack D, and M. Burno (1989): *Path Towards a Clearing: Radical Empiricism and Ethnographic Enquiry, Bloomington and Indianapolis*, Indiana University press.
13) Krishna, S. (1996): *The Environment Discourse in India; New Directions in Development* in T.V.Sathyamurthy (Ed.) "Class formation and political transformation," Vol.4, Delhi, Oxford University Press.
14) Kilgour, D. Marc.and Hipel, K. W. (2005): "The Graph Model for Conflict Resolution: Past, present and future", *Group Decision and Negotiation*, Vol.14, No. 6.
15) Luce, R.D.and Raiffa H. (1957): *Games and Decisions*, John Willey & Sons,Inc.
16) Prasad, A. (2007): "Survival at stake", *Frontline,* Vol. 23, Issue 26.
17) RLEK (1997): *Community Forest Management in Protected Areas*, Natraj Publishers, Dehradun.
18) Raiffa, H., Richardson, J., and Metcalfe, D. (2002): *Negotiation Analysis: The Science and Art of Collaborative Decision Making*, the Belknap press of Havard University press, Massachusetts.
19) Sensarma, S.R, and Okada, N. (2007a): "Game theoretic analysis of the process of player empowerment in resolving social conflict", *IEEE International Conference on Systems, Man, and Cybernetics, Montreal, Canada* (in print).
20) Sensarma, S.R, and Okada, N. (2007b): "Social conflict over displacement, resource rights and survival risk: A case study of Rajaji National Park, India", *Annuals of Disas. Prev. Res. Inst.*, Kyoto Univ., 2007 (in print).
21) Skyrms, B. and Pemantle, R. (2000): "A dynamic model of social network formation," *PNAS*, Vol. 97, No. 16.
22) Vikalp. (1994): "Rajaji National Park: Conservation, conflict and people's Struggle", *Vikalp Social Organization, Saharanpur, Mimeo*.
23) Vikalp nd. "The Right to Resources: History of the Ghad Kshetra Mukti Morcha (GKMM)", *Vikalp Social Organization, Saharanpur, Mimeo.*

CHAPTER 4: THE PROCESS OF STRUCTURAL CHANGE OF CONFLICT IN STRATEGIC AND BEHAVIORAL PERSPECTIVES*

4.1 Introduction

The major aim of this chapter is to model the Chizu-Ichinose community (Japan) disaster mitigation conflict which is seemingly resolved and then escalated. A combined approach of GMCR & drama theory is employed to understand the evolution of this conflict in a strategic and dilemmatic way. GMCR, a game theoretic approach provides a range of solution concepts under different strategic conditions. On the other hand, drama theory shows how the confrontation evolved over time and the characters engage in confrontation and keep changing their positions, preferences and perceptions through interactions with others. In the case of Chizu-Ichinose community disaster risk management conflict, the dilemma has arisen suddenly within a limited time to act strategically. The combined methodology of conflict analysis is used to systematically describe the process of structural change of this conflict which is already escalated.

4.2 Process Matters

Okada and Sakakibara (2004) proposed 'Scoping' as the dynamic process for changing structure of the conflict. The extension process of the resolution of the scope in a participatory manner is called 'Scoping' (Okada and Sakakibara, 2004). Conflict theorist Robbins (1991) proposed a perspective of the complex of conflict resolution process which can help to understand the dynamic mechanism of the conflict (Fig.4.1).

Stage I: Potential Opposition
At the first stage of the conflict, there is some potential opposition as an opportunity to evolve a conflict situation. Maybe, this does not directly lead to a conflict, but one of the components may be to facilitate the conflict. Different factors are involved in this stage, like, communication, organizational structure, scare resources, and threats of redundancy and take over, as well as a history of conflict. The recent research in conflict management focuses on informal or hidden disputes that occur off-line, behind closed doors, or in the crevices of organizations. The potential oppositions include complaining, ignoring requests, retailing, having hidden agendas etc.

Stage II: Realizations and Personalization
The potential for explicit opposition become realized in this stage. However, because a conflict is perceived does not necessarily mean that it is personalized. People may be aware that they had a co-worker are in disagreement, yet it may not make them tense or anxious and it may not influence work behavior towards the co-worker. It is at that level where conflict is felt, when individuals become emotionally involved.

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*Sensarma, S.R., Okada, N. (2006): "Conflict over natural resource exploitation in a mountainous community: The trade off between economic development and disaster risk mitigation --A case study," *Journal of Natural Disaster Science,* Vol.27, No. 2, pp. 95-100.
Sensarma, S.R., Okada, N. (2006): "Multistage conflict resolution process in the case of community disaster risk management: A retrospective analysis," *IEEE International Conference on Systems, Man, and Cybernetics*, Taipei, pp. 929-935, (CD ROM).
Sensarma, S.R., and Okada, N. (2006): "Analysis of the Chizu-Ichinose community disaster mitigation conflict: The process matters," *Infrastructure Planning Review, Japan Society for Civil Engineers***,** Vol.23, No. 4, pp. 299-308.

Stage III: Behaviors

In this stage, the conflict becomes revealed and unfolded. Overt conflict covers wide range of behavior. The level of the conflict may be in low level or may suddenly escalate. In this relation it is addressed the two-dimensional diagram of conflict behavior, which was proposed by Thomas as shown in Fig. 4.2. It identifies two conceptually independent dimensions of interpersonal behavior as assertiveness and cooperativeness. The dimensions combine to identify five conflict – handling 'modes', i.e., avoiding, competing, collaborating and compromising. This model is very useful to analyze the practical conflict situation where parties perceive the conflict in their own way from competition to collaboration point of view.

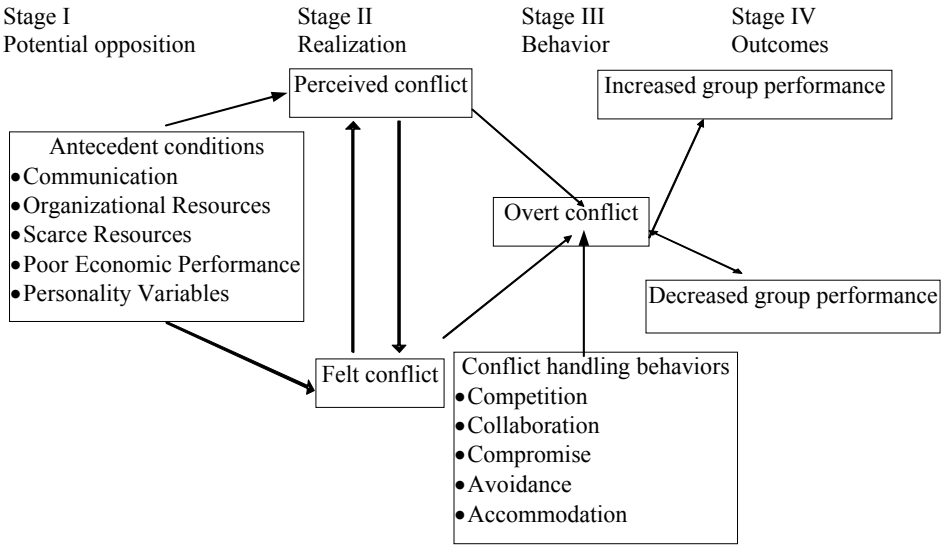

Fig. 4.1 The conflict process
Source: Reproduced from Robbins (1991), Furnham (2005)

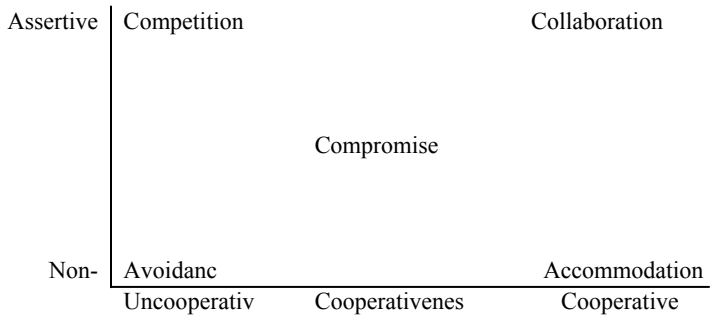

Fig. 4.2 Dimensions of conflict-handling orientations
Source: Reproduced from Thomas (1976), Furnham (2005)

Stage IV: Outcomes

The outcomes of the conflict could be positive or negative or may be partially mixed. This can be interpreted as an outcome of structural change in the time evolving conflict. Conflict can improve the quality of multiple stakeholders' decision making process, and can create an environment to solve the problems in a better way. But some times, conflict can escalate in a destructive way also. The third outcome is mixed when it seems to be bad for specific party but can enhance the other groups' performance.

4.3 Case study: Chizu-Ichinose Community Disaster Mitigation Conflict

4.3.1 Background of the Conflict

Ichinose, a mountainous community, is located in the town of Chizu (Tottori prefecture) in Japan (Fig. 4.3). It is a very small community having 32 households. Due to potential land resources, the local government planned to explore the rock resources from this area for the construction of roads and other civil work. Thus, the rock quarry became a resource base for local development. Around 30 years ago, one local quarry company (Hisamoto Company) entered this area in support of the local government, and this contract agreement intended to include safety measures from the company side. Confrontation evolved when the local company refused to take what seemed to be possible action for disaster mitigation work ordered by the local government. In order to model the conflict, the information is synthesized from many sources like the news paper articles and the interview with the stakeholders. The history of the conflict is described here in different time periods in Table 4.1.

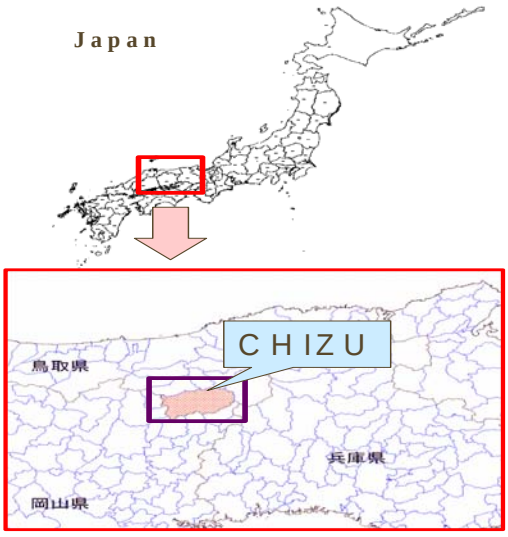

Fig. 4.3 Location map

4.3.2 Model of the Conflict

The whole process of the conflict is divided into two phases and the interpretation of the structural change (escalation) of this conflict is modeled which is occurred at the end of the second phase of the conflict.

4.3.3 First Phase of the Conflict (1985-2001)

4.3.3.1 Strategic Analysis

This conflict is modeled by use of GMCR II, a game theoretic model to find out the possible move of different players within a fixed set of options and within which equilibrium has apparently been reached. The possible transition of different equilibrium gives different insight under which condition the agreement can be reached. March 1985 saw the start of phase I and is the point in time for which the modeling and analysis was conducted. Two players have been identified in this conflict i.e., the local company and the local government. The local government consists of the prefectural government and the town office. At that time, players, their relative options, and the status quo are listed below in Table 4.2. Mathematically, there are a total of 32

(2^5=32) possible states, but after removing all infeasible states, there are 14 feasible states in total in Table 4.3.

Table 4.1 Chronology of the Conflict

Year	Occurrence	Action taken
1985	On March 23, a landslide occurred and the debris fell into the River Sendai (43,000 m^3).	Notification by the local government Clearance of the piled-up waste from the river. Taking emergency measures.
1996	Again on September 27, another landslide occurred, the debris fell into the River Sendai (30,000 m^3), and a large crack was discovered along the ridge.	Notification by the local government Clearance of the piled-up waste from the river. Order for emergency measures. Notification for suspension of rock quarry operation.
	On September 24 and 25, due to heavy rainfall, another landslide occurred at the quarry site and the earth fell into the River Sendai.	Notification by the local government Clearance of the landslide (securing of a pocket) and construction of a deposit pond.
	Again on October 25, earth (50,000 m^3) that was piled up at the quarry site crumbled due to a typhoon (1825 mm ppt) and fell into the River Sendai. Six houses in the Ichinose community were affected very badly. National highway no. 53 and part of the tunnel was blocked. The JR line and some quarrying equipment of Hisamoto Company were also washed away.	The local government rebuilt the riverbed and the local company cleared the disposed of earth.
2002	On January 25, a big landslide occurred and the piled-up waste was dumped at the waste treatment site. The river flow was blocked due to the landslide (dam formation).	The local government ordered Hisamoto Company to remove the rocks and debris from the site. However, Hisamoto Company refused to do this job and local government thus ordered Hisamoto Company to make reimbursement for expenses incurred in the restoration process in accordance with river loss. The amount claimed was 1,736,604,804 yen and on March 12, the property of the company was totally confiscated.
2004	Owing to the heavy rains caused by typhoon no. 21 on 29th to 30th September, the Sendai River flooded. Furthermore, due to the heavy rains, the left-hand cliff of the mountain collapsed, and soil and rocks fell to the riverbed, which resulted in dam formation. Because of this, ten houses and the community center were completely flooded, the JR line was closed by for one and half days, and mud and rubbish accumulated on the tracks.	Temporary shelters were arranged by the local government and they also established a disaster mitigation office in the Ichinose community to monitor the disaster mitigation work and operate an early warning system. On June 20, a new governor was elected.
2005		Monitoring the Early Warning System (EWS) by the local government.

Some states are infeasible because they are mutually exclusive. In Tables 4.2 and 4.3,'Y' means 'Yes' and indicates that the option is taken for a corresponding state, and 'N' means 'No', where the option is not taken. The local company's ranking state from most preferred to least preferred was, and the local government's preference order was. Here, only equilibrium, i.e., state 9 (under all stability conditions) is obtained, which was also the status quo state at that time. The graph model helps to describe the actual outcome as equilibrium in this game. It seems that although the local government suspended the local company's quarry work for a while, they again gave approval to continue the rock quarry work. However, the company was not ready to take the

proper measures for the disaster mitigation work ordered by the local government. Under this condition, the agreement was not stable and neither did the local government use their power to enforce the agreement. Thus, the delay of a concrete agreement upset the status quo state (modeled as a stable state). Neither the local company nor the local government made potential improvements from the status quo state. On 25th January 2002, a large-scale landslide occurred, and this natural disaster accidentally triggered a social shock that forced the game to move on to another phase of the conflict.

Table 4.2 Players and their Options, March 1985 (Phase I)

Players and their options	Status Quo State
Local company	
1. Rock quarrying and dumping at the site	Y
2. Operating and maintaining the EWS	N
Local government	
3. Allowing rock dumping by local company	Y
4. Operating and maintaining the EWS	N
5. Monitoring safety performance	Y

Table 4.3 Feasible States of the Conflict (Phase I)

States / Options		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Local company	1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	2	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
Local government	3	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
	4	N	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y
	5	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y

4.3.3.2 Drama Theoretic Analysis

Drama theory is introduced to address the psychological aspects of players involved in this process and how they have changed their positions and understandings in different episodes. All the characters have faced different dilemmas at the moment of truth in the evolution process. The metaphor of drama describes the interaction of different characters and how they change their preference, develop and perceive the new outcomes. A filled in shape signifies that the character has taken this option and empty shapes means that character has not accept this options and '—' represents either/ or – the option may or may not be adopted. The frame of this confrontation has also shown the dilemmas facing each of the characters. The local company's position is that they want to continue rock quarry, but not ready to operate and maintain the EWS and more over they do not like the local government's monitoring about the safety performance. But from the local government point of view, the local company should operate and maintain the EWS along with their quarry work. As a result of this confrontation, the threatened future has evolved where both parties are continuing disagreement due to the lack of coordinated policy. In the threatened future the local government will continue the monitoring of the safety performance, but there is a doubt whether they will operate and maintain the EWS or not. Thus the threatened future is particularly bad for the local company. Table 4.4 shows the interaction of different characters at that moment of time. The local company faces a persuasion dilemma with respect to the local government because the local government prefers the threatened future to the local company's position. The local company can change their preference to make compatible with the local government, or

they can try to change it by making the local government prefers some future in its (local company's) position to the threatened future. The local company has also a rejection dilemma with the local government. Here both the characters would rather accept than the stalemate. Each character has a pressure to implement their position. The analysis of the confrontation is brought out by the 'Tug-Of-War' diagram in Fig. 4.4. Here the positions of the two sides are shown by balloons enclosing brief descriptions. The fallback is shown by a rectangle. Parties' preferences between others' positions and the fallback are shown by horizontal arrows. The doubts (question marks in the option board) are shown by vertical arrow (down ward) with brief description. In this Fig.4.4, the arrow showing the local company's preference for threatened future over the local government's position and the vertical arrow from the threatened future shows the doubt of implementation. To eliminate their dilemmas, they need to come on a common ground where both parties can work together. Since, the local government has more power, so they can force the local company to co-operate with them. But neither character had potential improvement to its position. This was the status quo state in that time. Drama theoretic episode lies not in action as such; rather it is more contexts depended. In January 2002 a big landslide happened and it tuned to move the drama on to another episode.

Table 4.4 Confrontation Card Table –Phase I (Episode I)

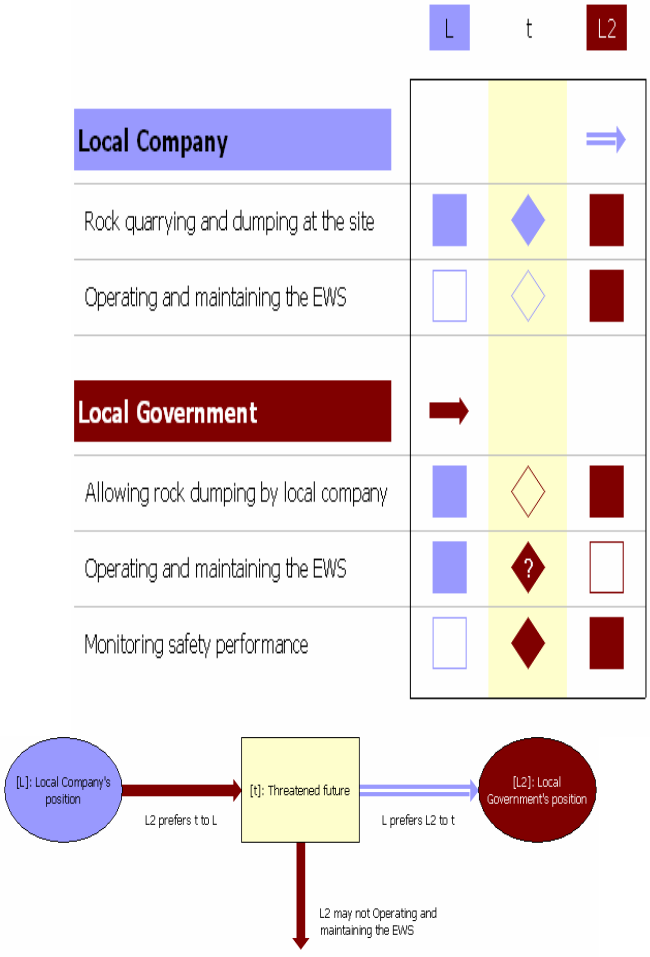

Fig. 4.4 Tug-Of-War diagram (Episode I)

4.3.4 Phase II (2002-2006)

4.3.4.1 Strategic Analysis

The second phase of the conflict started on 25th January, 2002. At that time, the local community became a player in this game and the different issues and sub-issues thus changed the structure of the game. The players and their options, and the status quo state are listed below in Table 4.5. In this conflict, there are a total of 512 states (2^9=512). However, many of the states are not feasible for actual conflict for different reasons. For example, the local community has two options: to stay in the same village with disaster preparedness, or to shift the village with public facilities. Both are mutually exclusive, so they are infeasible options. However, in case of the local government, out of four options, there are two options, i.e., rock and debris clearance from the site, and operation and maintenance of the EWS, both of which are mutually exclusive for the local company. This may be possible with the coordination of both players. So, in this case, it is regarded as a feasible state for both players. After removing the infeasible options, a total of 18 states were identified for this conflict in Table 4.6. The players' ranking of states from most preferred to least preferred is as below:

The local community: $13 \succ 11 \succ 12 \succ 17 \succ 10 \succ 5 \succ 3 \succ 4 \succ 15 \succ 2 \succ 9 \succ 7 \succ 8 \succ 16 \succ 6 \succ 14 \succ 18 \succ 1$,The local company: $1 \succ 10 \succ 2 \succ 6 \succ 12 \succ 4 \succ 11 \succ 3 \succ 7 \succ 13 \succ 5 \succ 9 \succ 17 \succ 15 \succ 16 \succ 14 \succ 18$,The local government: $18 \succ 1 \succ 13 \succ 5 \succ 9 \succ 11 \succ 3 \succ 7 \succ 12 \succ 4 \succ 8 \succ 17 \succ 15 \succ 16 \succ 14 \succ 10 \succ 2 \succ 6$.

The player's preferences over the states defined by the combination of options can be ranked by using option prioritizing. In this case, option prioritizing is defined by the importance and desirability of two properties of a state from the viewpoint of the player. To understand the behavior of each player in this conflict situation, stability analysis has been conducted. In this analysis, the status quo state does not appear as an equilibrium state. There are multiple equilibria in this conflict. States 1, 11, 12, 13, 17 and 18 are the possible equilibria in this conflict. It is noted though the analysis has focused on only explicit aspects of the conflict, but there must be many creeping metaphases before escalation of the conflict. The potential phases or hidden phases could have also contributed to the escalation of the conflict into what is observed as evidences. There could have been more potential oppositions like ignoring proper rules and regulation, unclear agenda etc. In this game all the equilibria are on the pareto frontier except for equilibrium 17, which is dominated by the states11, 12, and 13.

Table 4.5 Players and their Options, January, 2002 (Phase II)

Players and their options	Status Quo State
Local community	
1. Staying in the same village with disaster preparedness	Y
2. Shifting the village with public facilities	N
Local company	
3. Clearing rocks and debris from the site	N
4. Operating and maintaining the EWS	N
5. Appeal to the national government	Y
Local government	
6. Assisting the local community to shift the village	N
7. Order to clear rocks and debris from the site	Y
8. Operating and maintaining the EWS	N
9. Waiting for the national government's judgment	Y

From the Fig. 4.2, it can be interpreted that the competition between the local company and the local government took place which shifted the situation towards a polarization, however, the compromise were possible between the local government and the local community. The situation is reflected in the stage III to stage IV of Fig. 4.1. In this case none of the players might realize their full goal before escalate the conflict. In this very complex situation, the dilemma has arisen suddenly within a limited time to act strategically. Thus it provides only the cost to all the players involved in this game without any benefit and the conflict continued. Perhaps, there were uncertainty and misunderstanding among both the parties to perceive each others standpoint or both of them were waiting to come up with an acceptable offer to resolve the dispute. It may interpret that neither the local company nor the local government had the appropriate information from the other sides. Otherwise, a new proposal either from the local company or the local government side could bring the conflict in the state 11, 12 or 13 or a new proposal can also change the structure of the game. It can be interpreted that both the local government and the local company perceived the conflict as a zero-sum game in the escalation phase.

Table 4.6 Feasible States of the Conflict (Phase II)

States / Options		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Local community	1	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-
	2	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	-
Local company	3	N	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	N	N	N	-
	4	N	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	N	N	-
	5	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
Local government	6	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	-
	7	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	N	Y	N	Y	-
	8	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	-
	9	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y

4.3.4.2 Drama Theoretic Analysis

Just after the 2002 landslides, the local community became active and they started to take part in this drama. Thus the drama was transferred to another frame with all parties new fall back positions. In that time the local community had two options. One is to stay in the village with disaster preparedness and another is shifting the village with public facilities. The local government was ready to help the community to shift from their present location. But the local community was not ready to move from their locality. So, the local community preferred that both the local government and the local company have to do rock clearances work and immediately they should start the EWS. But the local company refused to do that job and thus both the local company and the local government started confront. As follows, the local government ordered to the local company for reimbursement of expenses incurred in the restoration process. The local company appealed to the national government, but ultimately on March 12, the property of the company was totally confiscated. Table 4.7 shows the new card model at the 'moment of truth' in this phase. In 'Tug-Of-War' diagram in Fig. 4.5, also shows that the local company still prefers the threatened future over the local government's position and the local community is also in a confrontation mode with others. The vertical arrow shows the same doubt as mentioned earlier. Since the local community was not ready to move from their location, thus they had negative emotion towards both of other parties. If the company would work together with the local government then dilemmas can eliminated. The local Community faces a rejection and persuasion dilemma with respect to the local company and also a rejection dilemma with the local government. The threatened future is really bad for the local company,

because if the local company does not co-operate with the local government then the local government can certainly settle down the conflict with the help of the national government's order which may not be in favor of the local company. Since the local community refused to move from their location, thus the local government faces a rejection dilemma with the local community and a persuasion dilemma with the local company.

Table 4.7 Confrontation Card Table - Phase II (Episode II)

	L	t	L2	L3
Local Community			⇒	⇒
Staying in the same village	■	◆	▬	▬
Shifting the village	□	▬	▬	■
Local Company	➡			⬅
Clearing rocks & debris	■	◇	□	■
Operating and maintaining the EWS	■	◇	□	■
Appeal to the national government	▬	◆	■	■
Local Government	⇐		⇒	
Assisting the local community	□	▬	▬	■
Order to clear rocks and debris	■	◆	□	■
Operating and maintaining the EWS	■	◆ ?	■	□
Waiting for the national government's judgment	▬	◆	■	■

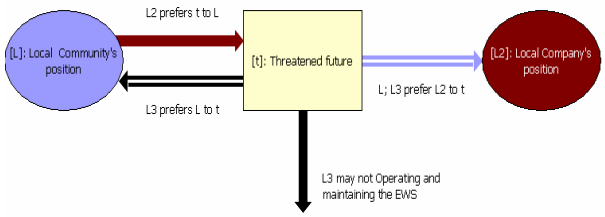

Fig. 4.5 Tug-Of-War diagram (Episode II)

Drama develops over a series of episodes. It may interpret that within this phase, the local government realized the local community's demand and they had a positive emotion towards them. So, the local government changed their preferences. The modified 'moment of truth' (redefined game) is descried in Table 4.8. During this phase, both the local community and the local government face a rejection and a persuasion dilemma with respect to the local company. In this phase, the local community and the local government have no dilemma with respect to each other. A positive emotion played a role. In this phase, 'Tug-Of-War' diagram in Fig. 4.6 analogy explains that during this phase the local government's preferences shifted towards the local company, but collaboration between the local company and the local government collapsed in an escalatory way.

Table 4.8 Confrontation Card Table - Phase II (Episode III)

	L	t	L2	L3
Local Community			⇒	
Staying in the same village	■	◆	▬	■
Local Company	➡			⬅
Clearing rocks & debris	■	◇	□	■
Operating and maintaining the EWS	■	◇	□	■
Appeal to the national government	■	◆	■	■
Local Government			⇒	
Order to clear rocks and debris	■	◆	■	■
Operating and maintaining the EWS	■	◆	■	■
Waiting for the national government's judgment	■	◆	■	■

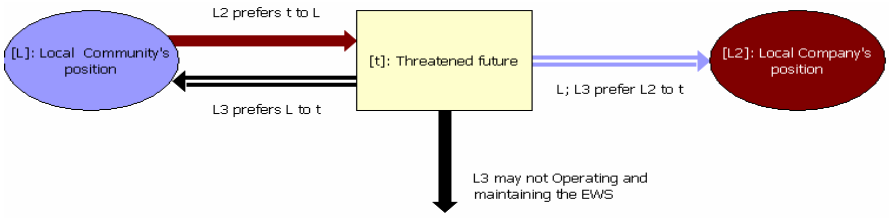

Fig. 4.6 Tug-Of-War diagram (Episode III)

Basically the confrontation crystallized between the local company and the local government. During this phase neither player had the potential improvement from their position. Thus it tuned to worse, like a zero-sum game. The local company did not have any attitudes to co-operate with the local government and they ignore the deterrent and they force the local government to consider the conflict in an extreme way. But before this confrontation, both the local company and the local government had co-operation and trust with each other. But disagreement has emerged during the task periods. Some strong emotional force triggered the confrontation as modeled on the form of zero-sum game. As Purit (1986) stated, " zero-sum thinking can result from a negative attitude toward the other party, which makes one unwilling to contribute to the others welfare, or from a personality disposition akin to authoritarianism, which leads to a view

of the world as a jungle in inevitable competition with every body else.'' The threatened future is very bad for all the parties. But historically the conflict escalated in a non-cooperative way and everybody paid the cost. The strong emotion and tension played the vital role to break what seemed to be a rational and strategic choice of players in a crisis period.

4.3.5 Structural Changes in a Drama Metaphor

Structural change of this conflict is modeled by using Pruitt's 'Augmented Structural Change Model' (1986). The drama theoretic perspective gives more insight into this model. According to the 'Structural Change Model', aggressive and heavy tactics used in conflict does not lead to conflict resolution. Instead they produce negative changes in the parties and the communities to which they belong. A change could evolve into more positive or negative in player's coping (resolving) capacity. In this particular case the actual outcome was the latter case, somewhat degraded and escalated into an adversary position for all the players. Thus the escalated conflict is both antecedent and consequent of structural changes. In this conflict both the local government and the local company developed enemy images to each others and thus communication broke down. The local government responded with heavy tactics to stop the local company's further quarry work. Subsequently the local company also used the heavy tactics and preferred to settle down this use in the local court.

As Pruitt mentioned (1986) that if structural changes in party involve the development of negative perceptions of other, this encourages the party to behave in ways that are represented by other (path way D), evoking negative perceptions in other (pathway A), which produce behavior (pathway B) that confirms party's original views (pathway C). A similar circular process can confirm others negative view of the party. This process is shown in Fig. 4.6 in the respective case. The local company's negative attitude towards the local government causes to break the agreement. This casual sequence of the local government and the local company's negative perception is shown by the dashed lines M and N in Fig. 4.7.

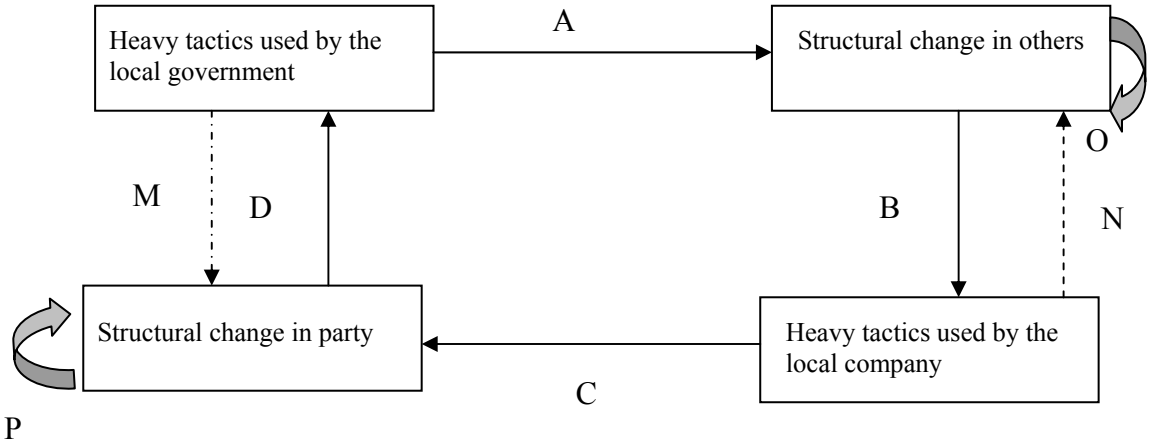

Fig. 4.7 Augmented structural change model

It can be interpreted that the competition between the local company and the local government took place which shifted the situation towards polarization. The metaphor of drama explains that moving on to the climax phase; both the local government and the local company faced a persuasion and a rejection dilemma. A strong negative emotion reinforced the local government and the local company to stay in their frame. These paradoxes could be solved by changing their position or frame. But both the parties used the heavy tactics to others. Thus, the collaboration

broke down and failed to reach a strong equilibrium in drama theoretic sense. The interpretation is that the intervening social shock caused by the repeated landslide has triggered the contextual shift in the development of the conflict. It may also infer that some political climate change such as a new governor being elected and coming in office could have also contributed to such a quantum jump in the structure of the conflict. In fact, there are side evidences to infer that the incumbent governor who was elected in 1999, and reelected in 2004, had taken an initiative to change the context of conflict. As a rational course of action, both parties become able to change their position and reframe their views. But the strong negative attitudes lead to hostile actions against others and it was the breakdown of rationality. Thus the cooperation collapsed.

4. 4 Complementary Analysis and Insights

Two decision models have been applied in this conflict to structure the strategic and behavioral interaction of players in a conflict situation. GMCR provides a range of solution concepts in different conditions within a fixed frame of game. It gives the analytical insights of players' strategic behavior in a conflict, their possible move and counter move. On the other hand drama theory gives more insight about the emotional, psychological and rational-irrational tradeoff in decision making process. Drama theory allows more contextual analysis of the conflict and it can model different episodes within the same phase also. Thus the creeping metaphases can be captured by using this model. It can be interpreted in the above case that in the last episode the characters (Players) were not able to eliminate their dilemmas due to strong negative attitude towards others. Thus, the drama could not proceed towards a strong equilibrium. The combined game theoretic and drama theoretic model gives more insight into the evolution and structural change of the conflict. As Bryant (2007) mentioned, "Drama theory could explain the pressures felt and imposed by all parties to achieve a meaningful agreement and a fair basis for contribution: game theory might be used to understand why such an agreement had apparently been reached, one party then failed to deliver what it had offered. So, in this sense drama theory and game theory are complementary, each dealing with a distinct part of the overall process."

4.5 Conclusions

To look at the whole picture overall it is noteworthy of meeting the need for brining some integrated framework to systematically place this type of long-term conflict resolution process. For this purpose the IRGC (International Risk Governance Council) framework may refer which consists of the cyclic process of pre assessment, risk appraisal, tolerability, and acceptability and risk management. The consensus building practice in decision making is only possible when all the stakeholders can participate in the discourse. The facilitation of players' common knowledge and external knowledge provided by the third party can also change the status quo state and may help to find out the acceptable common ground for all the concerned players in a conflict. A lesson could be derived from this study that before taking on any quarry-related project, local government must engage the local community to ensure their interests are served through participatory planning. At each stage, verification of ongoing work should be assessed, and information must be shared among different stakeholders. This study also emphasizes that incorporating a dispute resolution mechanism, if well managed, will further ensure the success of local-level development processes.

References

1) Bennett, P, Howard, N, and Bryant, J. (2001): "Drama theory and confrontation analysis", in Rosenhead,J, and Mingers, J. (eds.): *Rational Analysis For a Problematic World Revisited*, Wiley ,Chichester, 225-248.
2) Bryant, J.W. (2003): *The Six Dilemmas of collaboration: Inter Organizational Relationships as Drama*, Chichester, Wiley.
3) Furnham, A. (2005): *The Psychology of Behavior at Work: The Individual in the Organization*, Psychology press, Hove and New York.
4) Fang, L., Hipel, K.W., and Kilgour, D.M. (1993): *Interactive Decision Making -The Graph Model for Conflict Resolution*, Wiley New York.
5) Fraser, N.M., and Hipel, K.W.91984): *Conflict Analysis Models and Resolutions, New York,* NY: North-Holland.
6) Howard, N. (1999): *Confrontation Analysis: How to Win Operations Rather than War*, CCRP, Department of defense, Washigton, DC.
7) Howard, N., Bennett, P.G., Bryant, J.W., and Bradley, M. (1992): "Manifesto for a theory of drama and irrational choice", *Journal of Operational Research Society*, Vol.44, pp.99-103.
8) Howard, N. (2007): *Oedipus Decision Maker: Theory of Drama and Conflict Resolution,* available: http://www.dilemmasgalore.com.
9) Howard, N. (2004):"Resolving conflict in a tree : Drama theory in the extensive form", *presented at the international conference on ''Analyzing conflict and its resolution*", sponsored by the Institute of Mathematics and its Application, held in Oxford, England, available from : http://www.ima.org.uk/conflict/papers.html.
10) International Risk Governance Council, available http://www.irgc.org/irgc/spip.php?page=irgc&id_rubrique=2.
11) Kolb, D.M., and Bartunek,J.M., eds.(1992), : *Hidden Conflict in Organizations, Uncovering the Behind-the-Scenes Disputes*, Newbury Park,CA: Sage.
12) Nihon Kai Shinbum, dated 28 January, 2002, February 6, 2002.
13) Olczak, Paul V., and Pruitt, D.G. (1995): "Beyond Hope: Approaches to resolving seemingly intractable conflict," in C*onflict, Cooperation and Justice*: Essays Inspired by the Work of Morton Deutsch, edited by Bunker, B.B., Rubin, J.Z., and associates. San Francisco: Jossey-Bass.
14) Pruitt, D.G. and Rubin, J. Z. (1986): *Social Conflict: Escalation, Stalemate, and Settlement,* Random House Inc (T).
15) Robbins, S. (1991): *Organizational Behavior* (5th edn), Englewood cliffs, NJ: Prentice –Hall.
16) Stubbs, L., Tait, A., and Howard, N. (1999):"How to model a confrontation-Computer support for drama theory", *Proceedings of the 1999 Command and Control Research and Technology Symposium*, Naval War College, Newport, RI.
17) Sensarma, S.R., Okada, N. (2006): "Conflict over natural resource exploitation in a mountainous community: The trade off between economic development and disaster risk mitigation --A case study," *Journal of Natural Disaster Science,* Vol.27, No. 2, pp. 95-100.
18) Sensarma, S.R., Okada, N. (2006): "Multistage Conflict resolution process in the case of community disaster risk management: A retrospective analysis," *IEEE International Conference on Systems, Man, and Cybernetics*, Taipei, pp. 929-935 (CD ROM).
19) Sensarma, S.R., and Okada, N. (2006): "Analysis of the Chizu-Ichinose community disaster mitigation conflict: The process matters," *Infrastructure Planning Review, Japan Society For Civil Engineers***,** Vol.23, No. 4,pp. 299-308.
20) Sensarma, S.R., and Okada, N. (2006): "Multiparty conflict analysis under disaster risk: Using game theoretic model and drama theory as analytical tools," *Journal of Business and Technology* (Submitted for Review).
21) Sensarma, S.R., and Okada, N. (2006): "The process of conflict resolution: A case study of Chizu-Ichinose disaster management conflict, Tottori prefecture, Japan," *Annuals of Disas. Prev. Res. Inst., Kyoto Univ.,* No. 49B, pp.173-180.
22) Sensarma, S.R., and Okada, N. (2005): "The evolution and consequence of conflict resolution process in case of community disaster mitigation conflict: A case study of Ichinose community, Tottori prefecture, Japan," *Proceeding of the Annual Conference of the Institute of Social Safety*

Science, No 17, No.17,pp.139-142.
23) Sensarma, S.R., and Okada, N. (2005): "Modeling multi-actor decision process in conflict situation: a case of community disaster risk mitigation in Ichinose community, Tottori prefecture, Japan," *Annuals of Disas. Prev. Res. Inst., Kyoto Univ.,* No. 48 B, 48B, pp.83-94.
24) Tait, A. (1997): "Drama without tears," *Operational Research Society Tutorial Papers*.
25) Thomas, K.(1976): "Conflict and conflict management," in Dunnette, M.D. (ed), *Handbook of Industrial and Industrial Psychology*, pp 889-935, Chichester, UK; Wiley.

CHAPTER 5: ANALYZING THE PROCESS OF CONFRONTATION TO COOPERATION BY GRAPH MODEL AND DRAMA THEORY*

5.1 Introduction

This chapter intends to bring a new perspective on cooperation analysis in a conflicting situation addressing a case study of Yoshino river weir conflict (Japan) by the use of combined game theoretic and drama theoretic approaches. Game theoretic analysis shows how player can reach a cooperative equilibrium within a mixed set of cooperative and non cooperative equilibria. But in game theory, player's preferences are fixed. Drama theory describes how game can be changed in the context of players' threats and promises. The continuous (de)construction process of player's (character's) stands, beliefs and preferences leads them to eliminate each of the paradoxes and to find a common interest gradient. This also emphasizes that future can be created cooperatively by a group, rather than by way of confrontation in the conflict.

5. 2. Conflict Over Yoshino River Weir

About 250 years ago during the Edo period (1603-1867), the existing Daijuzeki dam on the Yoshino River-14 kilometers upstream from the Kii-sudio, a channel between Shikoku and the mainland-was built of stone masonry by the local farmers (Jain, 2000). According to the Ministry of Construction (MOC) officials, to prevent future flooding, the present fixed dam (koteizeki) made of piles of stones must be removed and replaced by a movable modern dam (kodazeki) to prevent the future flooding. Since the weir has become old, it has become an obstacle to river flow in case of flood (Fig. 5.1).That increases the risk of inundation upstream. The total estimated cost for constructing the movable dam on the Yoshino is over 100 billion yen (US $1 billion), with an annual maintenance cost of 700 million yen (US $7 million) (Jain, 2000). In 1993, the local people came to officially learn about the proposal. They established a study group (benkyokai) to gather information and raise the question of validity of replacement of the old weir. The opposition group with the support of local leaders began to start anti-dam movement in Tokushima. Their main arguments were as follows:

I. The new weir may not be as effective as compared to the cost of constructing the new renewal project.
II. Damage of water quality and ecosystem.

But despite the people protest, in 1997 the prefectural government and the assemblies of two cities and seven towns in Tokushima prefecture voted in favor of the new dam which triggered the opposition group to demand a referendum on the project. By the Japanese law, the result of a referendum in a municipality does not have any formal binding on the decision of the national government. At first, the Tokushima municipal assembly rejected to legislate a local ordinance for introducing a referendum. However the political groups supporting the referendum successfully obtained a majority in the election in April, 1999. The new assembly approved the

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* Sensarma, S.R., and Okada, N.: "Conflict and cooperation analysis by combined use of game theoretic and drama theory models: A case study of Yoshino River weir conflict, Japan", *International Journal of Risk Assessment and Management (submitted for review).*

institution of referendum, and this was carried out finally on January 23, 2000. In the referendum, 90% turnouts (almost a half of voters) voted for "opposition for the project" (http://www.topics.or.jp/daijyuzeki/). After the referendum, the mayor of Tokushima expressed his position to oppose the project. In August, 2000, the government declared suspension of the project, and called for establishing dialogues with the opposition group. However, communication did not work well because the opposition group complained that the Ministry of Land, Infrastructure and Transport (re established in 2001 from the former Ministry of Construction and the Ministry of Transport) would still not exclude the originally proposed project from the prospective alternatives.

In 2002, the governor of the Tokushima prefecture who had constantly been supporting the project was arrested for bribery and forced to leave office. Thereafter a newly elected governor declared his position in support of complete abortion of the project. But this conflict is yet not fully resolved to the date. Both of those supporting and opposing have been trying to stay in dialogue, thus it has been undergoing successive stages of conflict and cooperation (Table 5.1). The information is synthesized from different sources like official reports (The Yoshino River- Its Outline and Conservation, 1990), news paper clippings (http://www.topics.or.jp/daijyuzeki/) etc.

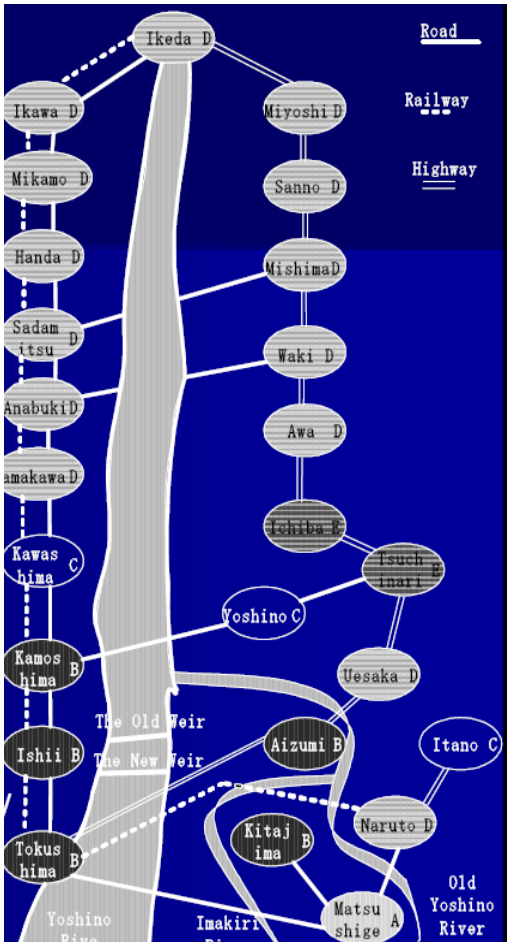


Fig. 5.1 Location of Yoshino River weir

Table 5.1 Chronology of the Conflict

Year	Events
1982	In a 1982 Master plan for the management of Yoshino river, the Ministry of construction announced that the current fixed weir should be replaced by a sluice-gate dam.
1984	Preliminary survey was started (Ministry of Construction).
1991	Location of new weir was decided.
1993	Opposition grouped formed.
1995	The Ministry organized "Dam & Other Projects Deliberation Committees (*damu to shingi iinkai*)" across the country.
October, 1995	Commission for reexamining the project.
May, 1998	Commission approved the project.
September, 1998	Opposition group asked for referendum.
February, 1992	Tokushima municipal assembly rejected a local ordinance for the referendum.
June, 1996	The referendum was approved in municipal assembly.
April, 1999	The group supporting the referendum obtained a majority in the election of Tokushima municipal assembly.
January, 2000	Referendum carried out. Majority opposed for the project. Mayor expressed to oppose the project.
May, 2000	Opposition group established NPO.
August, 2000	Project suspended.
April, 2001	Tokushima city established the group for a new alternative
	The governor was arrested for bribery. The newly elected governor declared aborting the project (April)
	Tokushima municipal assembly decided to provide opposition group with subsidy for proposing an alternative (Yoshino river basin vision 21 committee (VC).
December, 2002	Opposition group held symposium where experts on both sides participated.
March, 2003	A vote of nonconfidence for governor was passed at prefectural assembly.
May, 2003	A new governor was elected. He stated, "I will make an opportunity for discussion. If a new weir plan is obstacle for participation, which will be excluded from the alternatives for flood control." An official of the Ministry of Land, Infrastructure and Transportation (MLIT) said "A new weir is the best alternative" and the opposition groups stated, "A new governor should tell MLIT that Tokushima will not construct a new weir."
August, 2003	MLIT did not request the budget for a weir in the next fiscal year.
November, 2003	Governor talked with mayors of municipalities in the upper stream and downstream. They opposed to exclude a new weir from alternatives, but they did not necessarily insist a new weir.
January, 2004	Governor talked with mayors of municipalities in the midstream. Some said that flood control should be improved in any way. Some said that a new weir is the best.
February, 2004	Governor talked with opposition and supporting groups.
March, 2004	Governor stated basic principle for the problem at prefectural assembly. "For the time being" (or at first), a new weir was excluded from alternatives." ▪ Two places for discussion would be founded. One is the place for discussing flood control in the river basin, and the other is the place for discussing the weir. ▪ The existing weir would be repaired. ▪ Prefectural assembly accepted governor's principle. ▪ VC made a proposal that "A new weir is not necessary."
April, 2004	MLIT accepted prefecture's principle.
May, 2004	MLIT started the survey for repair of the existing weir.

September, 2005	Some members of the committee of MLIT "A new weir is the best."
October, 2005	MLIT started repair of the existing weir.
December, 2005	MLIT and opposition group discussed.
December 8, 2005	Opposition groups requested to the MLT ▪ Make a preparation committee for fairly discuss the methods and rules. ▪ Preparation committee and project discussion committee have to be independent and so they have to elect the committee person.
December 28, 2005	Prefectural government asked to the MLT to take account of people view, summarize the opinion of people view in different places and taking account of opinion from responsible persons in disaster mitigation.
December 22, 2005	MLT wants to hear people opinion.
January, 2006	The graduate student of Tokyo and Kyoto university visited the place and recommended that the local people should be more than half of the committee including the ecological group representative and someone who is affected by the construction.
2007	Discussion over flood management issue.

5. 3 Modeling of the Confrontation and Cooperation

Based on the chronological analysis as listed in Table 5.1, the whole process of the conflict is modeled into three phases to analyze how parties gradually find their cooperation ground over a series of interactions.

5.3.1 Phase I (1982-1999)

5.3.1.1 Strategic Analysis

This conflict is modeled by use of GMCR II, a game theoretic model to find out the possible move of different players within a fixed set of options and preferences, and within which equilibrium of the cooperation can be reached.

Based on the analysis of the background of the conflict, two players are identified. One is governmental agency (player G), and the other is the opposition group (player O). Player G consists of the Ministry of construction, prefectural government, and some municipalities located at upstream. At that time, players, their relative options, and the status quo are inferred as listed below in Table 5.2. Mathematically, there are a total of 32 (2^5=32) possible states, but after removing all infeasible states, there are 16 feasible states in total as shown in Table 5.3. Some states are infeasible because they are mutually exclusive. In Tables 5.2 and 5.3 ,'Y' means 'Yes' and indicates that the option is taken for a corresponding state, and 'N' means 'No', where the option is not taken. In the first phase of this conflict, the sate is 7 is an equilibrium under Nash and Sequential stability concepts. In this equilibrium, player G, proceeds the project and calls for dialogue. On the other hand, player O pushes the referendum and does not accept the call for dialogue. This was also the status quo sate during this time. This equilibrium can be interpreted as an initial situation of this conflict. But historically the sate 16 occurred at the end of this game where the governmental agency has suspended the project. An aspect of decision making that is poorly captured by game theory involves the cost of searching the solution space for an optimal result (Picard *et al*., 1999), and within the fixed frame of game, players find their best outcome. This cannot allow the game to change, which means we cannot break the rules as fixed in the beginning of the conflict. As we know, due to the strong people movement, the government agency has already started to communicate with the opposition group. They decide to alter the

preference structure to adapt to the public opinion which pushed the game to move on to the second phase of the conflict.

Table 5.2 Players and their Options (Phase I)

Players and their options	Status Quo State
Governmental agency	
1.Proceed the project	Y
2.Suspend the project	N
3. Dialogue with opposition group	Y
Opposition group	
4. Push Referendum	Y
5. Dialogue with governmental agency	Y

Table 5.3 Feasible States of the Conflict (Phase I)

States / Options		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Governmental agency	1	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	N	N	Y	N
	2	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
	3	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
Opposition group	4	N	N	N	N	Y	Y	Y	Y	N	Y	N	N	Y	Y	Y	Y
	5	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	Y	Y	Y

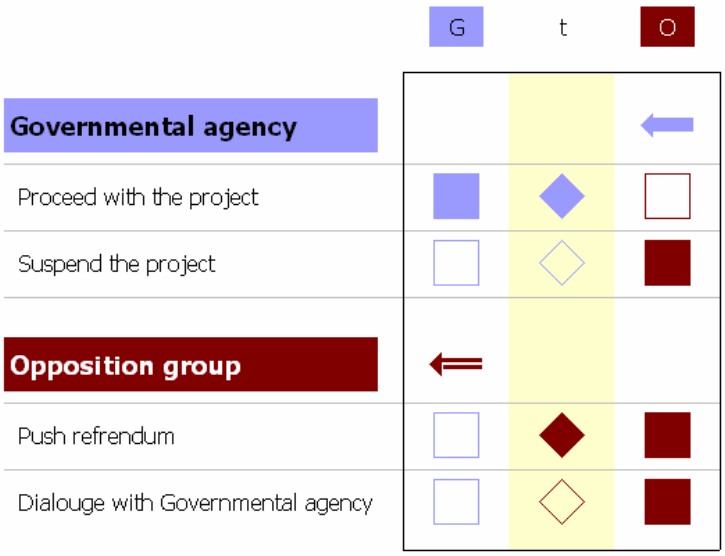
5.3.1.2 Drama Theoretic Analysis

The role of player's position is somewhat neglected in game theoretic analysis of conflict resolution. A character's position is whatever it is trying to convince the others to accept. It specifies a selection of cards to be played, typically including the both, i.e., one's demands on other characters, and some commitments of one's own. As in the everyday sense of the world, a position refers to a public stance: the character may or may not be sincere in intending to carryout its commitments. A common position may be held by two or more characters (Bryant *et al.,* 2001). Drama theoretic analyses now discuss how both parties position has changed over a period of time. This also emphasizes that future can be created cooperatively by a group, rather than by way of confrontation in the conflict.

Table 5.4 illustrates the card table for phase I of the conflict. This is the pre-play situation. All the characters have faced different dilemmas at the moment of truth in the evolution process. The metaphor of drama describes the interaction of different characters and how they change their preference, develop and perceive the new outcomes. A filled-in shape signifies that the character has taken this option and empty shapes means that character has not accepted this options, and '—'represents either/or, meaning the option may or may not be adopted. The frame of this confrontation shows the dilemmas facing each of the characters. The governmental agency is a powerful party in this confrontation. At least in the beginning, they seemed to have little intensive to change the current frame. They like to reinforce their position to the opposition group to accept it. The opposition group faces the threat dilemma with respect to the governmental agency because the governmental agency prefers the threatened future over the opposition group's position. Thus, the opposition group seemed to have an incentive to abandon its fallback position (or threat), and faced the persuasion and rejection dilemma with the governmental agency. To rid

off these three dilemmas, the opposition group would have had to make its threat of abandonment credible. To eliminate the persuasion and rejection dilemma, the opposition group can choose a new fallback position. The Tug-of-War diagram metaphor in Fig. 5.2 shows that all the arrows in this 'Tug-Of-War' point away from O indicating that the opposition group was loosing in this confrontation. The equilibrium 7 as obtained from the graph model is exactly corresponding the threatened future in Table 5.4. Equilibrium 7 is a Pareto dominated equilibrium and it implies that coordination for achieving a Pareto efficient equilibrium becomes necessary. Alteration of preference could cause the necessity of coordination (Sakakibara and Okada, 2004). This indicates the necessity to change the game. Later the local environmentalists put the public referendum issue which was to turn the confrontation in different episodes with eventually adopted different options and preferences.

Table 5.4 Confrontation Card Table –Phase I (Episode I)



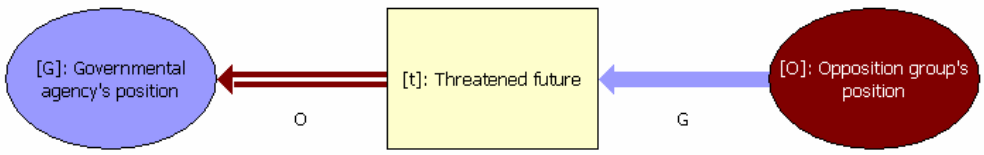


Fig. 5.2 Tug-Of-War diagram (Episode I)

The rules of the game are fixed in game theoretic analysis. It gives each player a fixed set of possible choices (sequential or simultaneous, continuous or discrete), says what outcomes (stochastic or deterministic) are expected from each mix of choices and fixes for each player and each payer of possible outcomes which of the pair that player should want (prefer). It is against the rules to change any of this (Howard, 2007). In drama theory, players (rather say, characters) communicate each others and redefine their game in terms of either changing their strategy or trying to change opponents' options and preferences. Drama theory also refers to the need for 'think outside the box', which means what is happening around the modeling. The externalities affect the character's behavior. Thus parties use emotion and tension to redefine their initial

position. Note that the game theoretic approach does not consider any external incidents outside the game, because the structure of the game is instrumentally fixed.

During this phase, the anti-dam movement led by the local environmentalists had a great impact on the Yoshino river weir controversy. Political parties and other organized groups gave strong support in this movement. Citizen groups held several symposiums at which Conservationists and scholars spoke and amassed a thick sheaf queries and fears that had been voiced by other members of the public. Thus this episode is transfer to another episode. In the next episode, the governmental agency changed their attitude, they suspend the project, but in order to revitalize the project they propose partial change of the plan.

Table 5.5 shows the new card model at the 'moment of truth' in this phase. In this episode, the opposition group is able to eliminate the threat dilemma, but still have persuasion and rejection dilemma with the governmental agency. Neither of the two parties achieved its position. 'Tug-Of –War' diagram in Fig. 5.3 gives a graphic representation of this situation. Because the horizontal arrows point toward G, G is winning the 'Tug-Of-War' -- its position is found to prevail unless other forces are brought to bear. The externality affects the character's behavior. Thus parties are affected by emotion and tension to redefine their initial position.

Table 5.5 Confrontation Card Table –Phase I (Episode II)

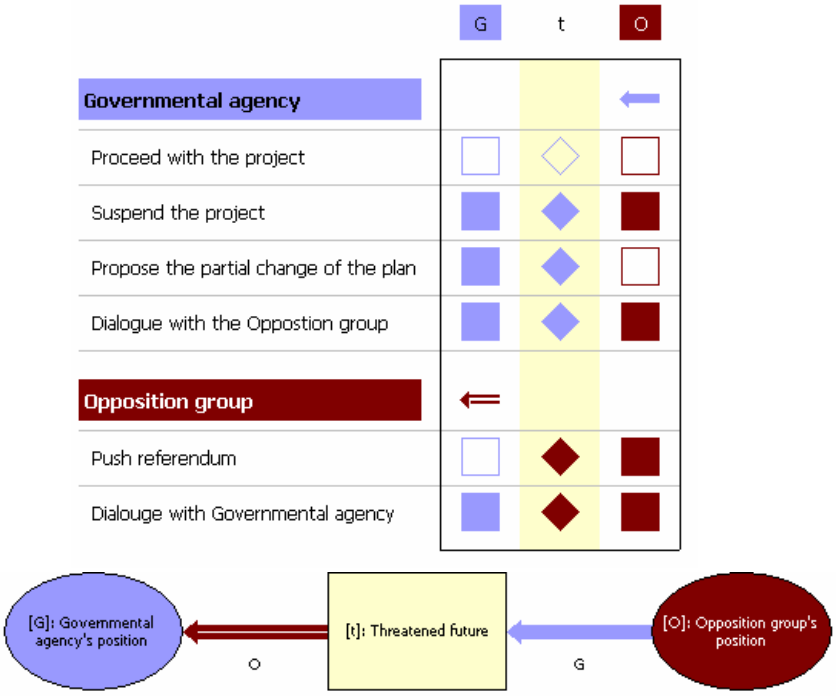


Fig. 5.3 Tug-Of-War diagram (Episode II)

A distinct shift in the nature of the conflict began as a result of public referendum. But it was not a random event. In Tokushima, local environmentalists, including Mr. Masayoshi Himeno who later became the leader of the movement for a public referendum took a strong role to stop the dam project. During this period, the proposed constructions of Nagara River Barrage in Gifu prefecture became a national debate issue. Awareness of anti-dam movement has further

enhanced by wide range of media coverage. Yoshino river project faced this trend against dam. This contextual external event forced the conflict to move on to the second phase of the conflict where the focus shifts towards whether the project is completely aborted or not.

5.3.2 Phase II (2000-2002)

5.3.2.1 Strategic Analysis

Thereafter, as the players continued to bring up various issues of pros and cons in public debates a new orientation of player interactions and counter interactions become more important. After the referendum the project has already been suspended, the opposition group tries to pressurize the government to abort the project. The governmental agency tries to revitalize the project proposing the partial change of the plan. Thus player's new options and preferences are identified as shown in Table 5.6. There are a total of 32 (2^5=32) possible states, but after removing all infeasible states, there are 16 feasible states in this second phase of the conflict (Table 5.7). This game has 3 equilibria, i.e., state 4, 8, 11, and 15. Equilibrium 4 and 8 are stable under both Nash and Sequential stability concepts. In equilibrium 4 and 8, governmental agency does not abort the project and propose their own alternative. The basic difference from equilibrium 4 to 8 is that, in equilibrium 8, and governmental agency also accepts the opposition group's alternative proposal. The equilibrium 11, and 15 are not stable under Nash solution, they are sequentially stable. In the equilibrium 11, player G aborts the project but does not accept the alternative proposal and in equilibrium 15, player G aborts the project and accepts the alternative proposal. But in fact, after the results of the referendum were announced, the then new Construction Minister (Mr. Masaki Nakayama) advised that he would not insist on going ahead with the plan if a better alternative could be found. Prior to the vote, Nakayama had maintained that construction work should be in process regardless of the local residents' opinion. Actually the equilibrium 8 (where governmental agency can aborts the project) can be interpreted as the actual outcome at the beginning of this phase. It may interpret that some political climate changes again forced the game to move on to phase III of this conflict.

Table 5.6 Players and their Options (Phase II)

Players and their options	Status Quo State
Governmental agency	
1. Abort the project	Y
2. Propose the partial change of the plan	Y
3. Dialogue with Opposition group	Y
Opposition group	
4. Propose its own alternative	Y
5. Dialogue governmental agency	Y

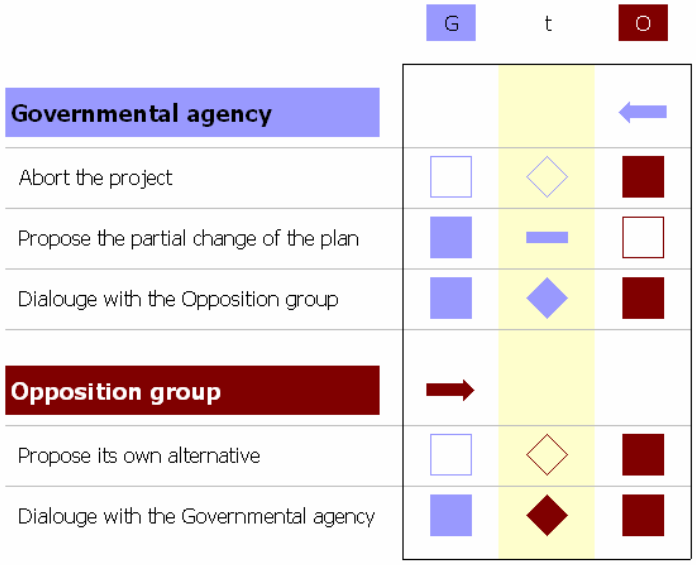
Table 5.7 Feasible States of the Conflict (Phase II)

States / Options		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Governmental agency	1	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	N	N	Y	N
	2	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
	3	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
Opposition group	4	N	N	N	N	Y	Y	Y	Y	N	Y	N	N	Y	Y	Y	Y
	5	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	Y	Y	Y

5.3.2.2 Drama Theoretic Analysis

After the referendum, focus shifts towards whether the project is completely aborted or not. The governmental agency's position was as yet not to abort the project, and they do not accept the opposition group's own proposed alternative. Their positions can represent as another 'moment of truth' where the government agency was not ready to abort the project and more interested to revitalize the project by changing the partial plan. Table 5.8 shows that each of the characters faced a persuasion dilemma----each found the threatened future palatable than the other character's position. As a result of their dilemma, the opposition group started to raise their voice to abort the project via the media, attempting to turn the public opinion against the governmental agency's position. Thus they try to make the fall back position unattractive to the governmental agency. 'Tug-Of-War' diagram in Fig. 5.4 points to strength and weakness in the parties' position.

Table 5.8 Confrontation Card Table –Phase II (Episode III)



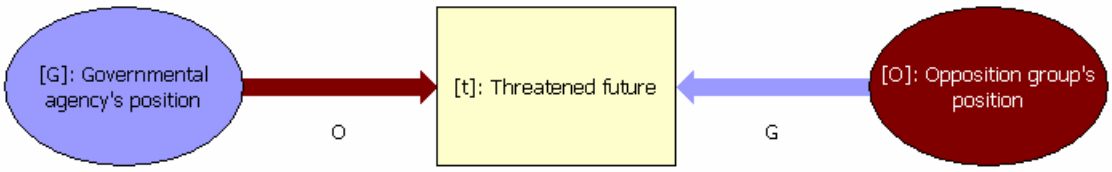
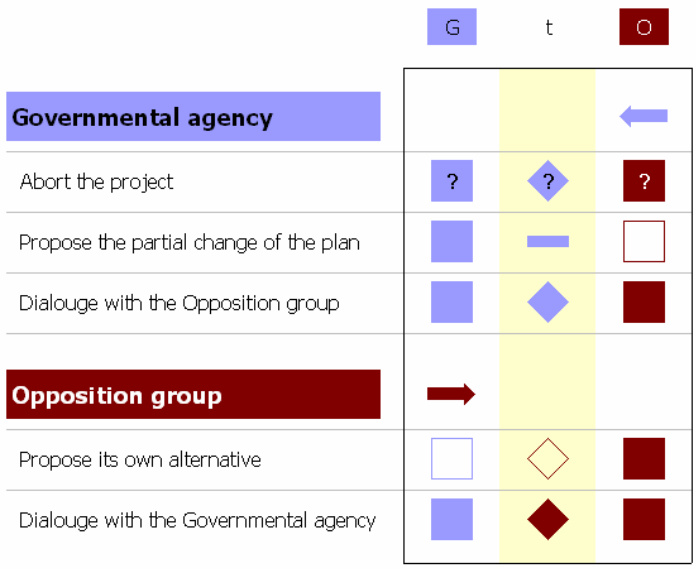


Fig. 5.4 Tug-Of-War diagram (Episode III)

As a means of continuous communication and result of anti-dam movement, the governmental agency again changed the frame-they created a new fall back position where they abort the project and propose partial change of the plan (Table 5.9). The positive emotion insisted to do so. But the opposition group has doubts that whether the governmental agency will implement the stated position or not. The both parties faced again a persuasion dilemma. The governmental agency has also a cooperation dilemma with the opposition group and opposition group has a trust dilemma with the governmental agency. 'Tug-Of-War' diagram (Fig. 5.5) gives a graphic representation of the party's strength and weakness in the ongoing confrontation. The horizontal arrows correspond to the parties' preferences (arrows) in the option board (Table 5.9) and the

vertical arrows correspond to the question marks. In May, 2002, the opposition group established a NPO to strengthen their voice. The increasing demand for referendum in Japan also moved the citizen to establish the opposition group to register their voice in the corridor of power. Thus, the opposition group represents the interest of citizen in this confrontation. In May, 2003 the new governor was elected and decided to abort the project.

Table 5.9 Confrontation Card Table –Phase II (Episode IV)



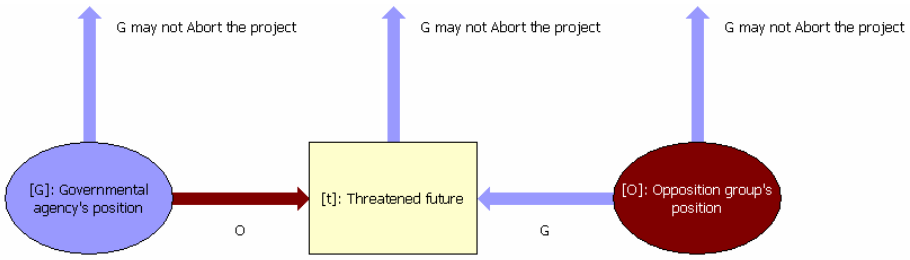


Fig. 5.5 Tug-Of-War diagram (Episode IV)

As mentioned in the above, drama theory allows the continuous change of options and preferences unless the parties find their satisfactory option on which they can agree. In 2003, Government of Tokushima prefecture heard opinions of mayors from 25 municipalities in the Yoshino river basin. Some mayors supported the construction, some of them opposed the construction and others insisted that it is not fair to consider the result of referendum of Tokushima city because Tokushima municipalities is just one of the municipalities in Yoshino river basin. It may also infer that some political climate change such as a new governor being elected could have also contributed to a quantum jump in the structure of the conflict to enforce the conflict to move on to another stage. The new governor stated, "If a new weir plan is an obstacle for participation that will be excluded from the alternatives for flood control." As a result of this interaction, both characters come up with a new option board which marks the start of the third phase of the conflict.

5.3.3 Phase III (2003-2007)

5.3.3.1 Strategic Analysis

The shift to phase III, began with new governor appointment and his further initiative to control the flood measure. In effect of this, the major focus shifts towards the flood management. In this phase both parties interaction become dominant. Although the players continued to disagree over the river weir issues, they increasingly became engaged in close communications and negotiations to find our some meeting point and to explicitly consider each other's views. Thus players' new options and preferences are specified as below (Table 5.10). There are a total of 64 (2^6=64) possible states, but after removing all infeasible states, there are 32 feasible states in this second phase of the conflict (Table 5.11). In the case of equilibrium 32, the governmental agency compromises with the opposition group. In this phase the governmental agency preferences shifted towards the opposition group and a new option to repair the old weir and flood control measures took place. The governmental agency now gives emphasis on dialogue with the opposition group. Still there remains a voice in favor of construction of the new weir, which might turn it to another conflict phase. The old weir may not have enough functions to control the floods, so the other measures should be considered to control the floods.

Table 5.10 Players and their Options (Phase III)

Players and their options	Status Quo State
Governmental agency	
1. Construction of new weir	N
2 Repair the old weir	Y
3. Flood control measure	Y
4. Dialogue with opposition group	Y
Opposition group	
5. Propose its own alternative	Y
6. Dialogue governmental agency	Y

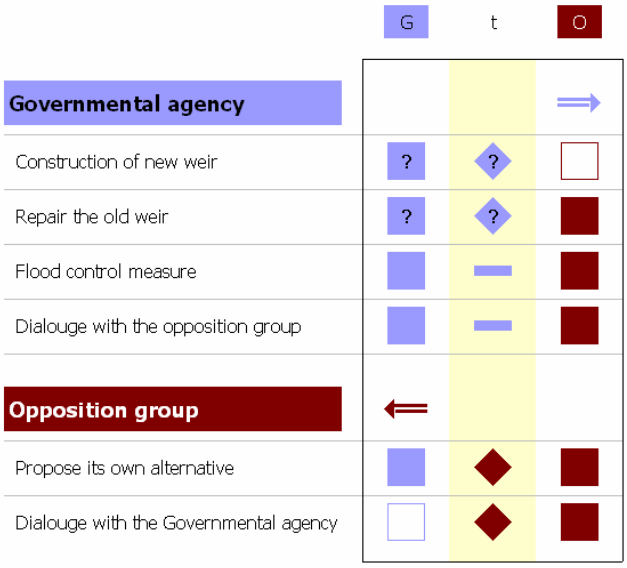
Table 5.11 Feasible States of the Conflict (Phase III)

States / Options		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Governmental agency	1	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	N	N	Y	N
	2	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
	3	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
Opposition group	4	N	N	N	N	Y	Y	Y	Y	N	Y	N	N	Y	Y	Y	Y
	5	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	Y	Y	Y
	6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
		17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Governmental agency	1	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
	2	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
	3	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
Opposition group	4	N	N	N	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y
	5	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
	6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

5.3.3.2 Drama Theoretic Analysis

Table 5.12 shows the new episode in this phase. The government agency faces the threat and cooperation dilemma with the opposition group, and the opposition group faces a persuasion and rejection dilemma with the governmental agency. In this phase, more emphasis is placed on the flood control measures. They are, however, not able to find their common ground. From the 'Tug- Of-War' diagram 5.6, confrontational centers of gravity (CoGs) can be defined for each party. (A party's center of gravity consists of all the reasoning necessary to make its position acceptable and stable, and its threats credible.) By strengthening the CoGs of parties that oppose us, we can win a confrontation. Here, strengthening means that the party can change their preference and also try to change others preference and may bring the new option sets.

Table 5.12 Confrontation Card Table –Phase III (Episode V)



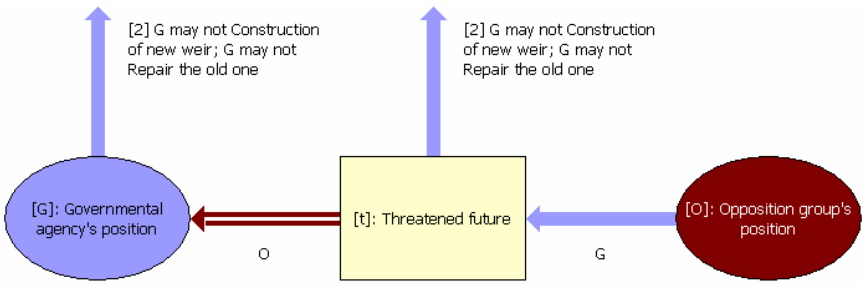


Fig. 5.6 Tug-Of-War diagram (Episode V)

The aim of drama theoretic approach is not merely to find a resolution; rather it gives more emphasis on how characters find to rid off from their dilemmas as a continuous communication process. Characters (de)construct their subjective reality in their objective frame either by changing their positions or insisting others to change their options and preferences. Thus there are

a number of generic ways characters may try to remove their dilemmas. They can only reach a strong equilibrium point when they do not find any potential improvement from their stated positions. But sometimes they fail to implement their resolution if someone breaks the promises or discards threats. Thus the dénouement is the last phase of the confrontation resolution if resolution is implemented. So, in another way, drama theory can address more on the real world implementation question rather than it simply describes the actual process in retrospect, or predicts the future in a very robust way.

In the last phase of this conflict, since both the parties have a common interest on the flood management issue, by giving more focus on it, parties can negotiate each others. A third party can act as a knowledge provider to assess the effective measures of the flood control and provides the unperceived options. If they cannot reach an agreement, a referendum can be exercised as an effective countermeasure (as mentioned above in the model consequences). The following trade-off would seem to be in the interests of both parties (Table 5.13). In the 'Tug-Of-War' diagram 5.7, since parties' converse to a common position, there is no arrow towards any party, they are in a collaborative gradient.

Table 5.13 Confrontation Card Table :Possible Collaboration

	G	a	O	C
Governmental agency				
Construction of new weir	□	◇	□	—
Repair the old weir	■	◆	■	—
Flood control measure	■	◆	■	—
Dialouge with the Opposition group	■	◆	■	—
Opposition group				
Propose its own alternative	■	◆	■	—
Dialouge with the Governmental agency	■	◆	■	—
Consequences				
If parties can't compromise, a referendum might be held	—	◆	—	■

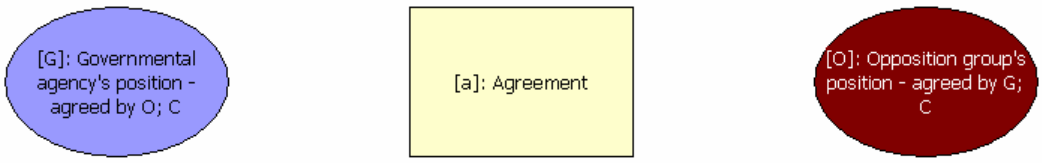


Fig. 5.7 Tug-Of-War diagram:Possible Collaboration

5.4. Complementary Analysis and Insights

The argument of this case study is to manifest a methodology of conflict resolution which has an emphasis on collaboration. Unfortunately game theoretic analysis ignores the transition phases of

the conflict. By using the GMCR model some equilibria can be captured, but not all the equilibria in a dynamic conflict. On the other hand drama theory asserts that full conflict resolution generally requires players to be engaged in rational-emotional process of re-defining both the game and their "positions" until there is a fully satisfactory resolution on which they all agree. In re-defining the game the player (de)constructs their subjective reality in their objective frame. Threats and promises are the inherent properties that control player's position. Thus, it can capture the transition phases of the conflict and its driving forces as an episodic transformation in a dynamic process.

Drama theory encourages players to communicate frequently in order to eliminate the paradoxes of dilemma they are facing during the confrontation. The elimination of each dilemma may require different tactics. The game theoretic orientation can give insights of strategic moves. All strategic moves – commitments, threats, and promises –must be credible (Dixtit, 2006). When parties find their common position (through their moves), they switch from confrontation to collaboration. But parties can break their collaboration to defect from their agreement. Thus drama theory emphasizes player's threats and promises over a dynamic interaction.

In this Yoshino river weir conflict now both players' preferences gradually appear to be shifting towards more integrated flood management issue. But within the same group some of the members still prefer the construction of a new weir. In order to resolve the further conflict referendum can be taken as a direct democracy. In this case, the present episode may further transfer to another episode with new agendas. By using two complementary models, a combined method of analyzing the conflict and cooperation is proposed to analyze the process of Yoshino river weir conflict over a period of time. The mixture of conflict and common interests are analyzed in different phases of the conflict, giving focus on how cooperation can be achieved.

5.5 Conclusions

This chapter extends to propose a combined game theoretic and drama theory approaches to analyze the cooperation where players have different conflicting and cooperatives interests. To achieve the collaboration the different strategic moves of players is analyzed in the context of threats and promises. Drama theory manifests how players are a continuous process to deconstruct their socially perceived reality in a dynamic process. To demonstrate this approach, the Yoshino river weir conflict is detailed and analyzed as an illustrative case.

References

1) Bennett, P.G., and Howard, N. (1996): "Rationality, emotion and preference change: Drama theoretic- models of choice," *Euro Jnl. of OR*, pp. 603-614.
2) Bryant, J.W. (2006): "Drama theory: Dispelling the myths", *Journal of Operational Research Society*, pp. 1-12.
3) Bryant, J. W. (1998): "Analyzing collaboration as drama," *System practice and Action Research,* Vol. 11, No. 4.
4) Bryant, J.W. (1997): "The plot thickness: Understanding interaction through the metaphor of drama," *Omega,* Vol. 25, pp. 255-266.
5) Bryant, J.W. (2003): *The Six Dilemmas of Collaboration: Inter Organizational Relationships as Drama*, Chichester, Wiley.
6) Dixit, A. (2006): "Thomas Schelling's contributions to game theory", *Scandinavian Journal of Economics*, Vol.108, No. 2, pp. 213-229.
7) Fang, L., Hipel, K.W., and Kilgour, D.M. (1993): *Interactive Decision Making-The Graph Model for Conflict Resolution*, Wiley New York.
8) Fraser, N.M., and Hipel, K.W. (1984): *Conflict Analysis Models and Resolutions*, New York, NY: North – Holland.
9) Fang, L., Hipel, K.W., and Kilgour, D.M. (1988): "The Graph model approach to environmental conflict resolution", *Journal of Environmental Management,* Vol., 27, pp.195 – 212.
10) Hipel, K.W., Fraser, N. (1991): "Cooperation in conflict analysis", *Applied Mathematics and Computation*, Vol. 43, Issue 2.
11) Howard, N (1971): *Paradoxes of Rationality*, MIT Press, Cambridge, MA.
12) Hgihara, Y, Hatayama, M, Sakamoto, M, and Okumura, J (2005): "Player integration process in risk allocation on the 10 th weir problem in Yoshino -river", *Annuals of Disas. Prev. Res. Inst., Kyoto Univ.,* No. 48 B, 48B, pp.851-876 (in Japanese).
13) Howard, N. (1994): "Drama theory and its relation to game theory", *Group Decision and Negotiation,* Vol. 3, 1994, pp. 187-206 and 207-235.
14) Howard, N., Bennett, P.G., Bryant, J.W., and Bradley, M. (1992): "Manifesto for a theory of drama and irrational choice", *Journal of Operational Research Society*, Vol.44, pp.99-103.
15) Howard, N. (2007): *Oedipus Decision Maker: Theory of Drama and Conflict Resolution*, available: http://www.dilemmasgalore.com.
16) Howard, N. (2004): "Resolving conflict in a tree: Drama theory in the extensive form," presented at the International conference on ''Analyzing conflict and its resolution", sponsored by the *Institute of Mathematics and its Application*, held in Oxford, England, available from : http://www.ima.org.uk/conflict/papers.html.
17) Jones M, P., and Howard. N (2001): "Co-coordinated positions in a drama –theoretic confrontation: Mathematical foundations for a PO decision support system," *CCRTS Symposium.*
18) Kilgour, D.M., and Hipel, K.W. (2005): "The Graph Model for conflict resolution: Past, present, and future", *Group decision and negotiation,* Vol. 14, No. 6, pp.439 – 440.
19) Kilgour, D.M., Hipel, K.W., and Fang, L. (1987): "The Graph Model for conflicts," *Automatica,* Vol. 23, 41-55.
20) Matsuura, M. (2007): "Localizing public dispute resolution in Japan: lessons from experiments with deliberative policy- making," PhD thesis, Department of Urban Studies and Planning, MIT.
21) Okada,N., and Sakakibar, H. (2002) : "Game theory-derived policy implications for the Yoshino River Weir conflict in Tokushima, Japan," *Systems, Man and Cybernetics, IEEE International Conference* on, Vol.6, Issue.6-9 .
22) Okada, N., and Sakakibara, H. (2004): "Conflict Management as a part of integrated disaster risk management – issues, socio-cultural contexts, and methodological leverages", *IEEE transition on systems, man, and cybernetics.*
23) Picard, R.,Graves,T.,and Booker, J.(1999): "Stability modeling and game-theoretic considerations," Los Alamos National Laboratory Technical Report, LA-UR-99-5360. Available: http://www.au.af.mil/au/awc/awcgate/gaming/stable-lanl-gov.pdf.
24) Pruitt, D.G., and Rubin, J.Z. (1986): *Social Conflict: Escalation, Stalemate, and Settlement*, New York, Random House Inc.
25) Schelling, T. (1980): *The Strategy of Conflict*, Cambridge: Harvard University Press.

26) Sakakibara, H., and Kidear, K. (2004): "The study on the process of constructing a game from a conflict in participatory planning," *IEEE Transition on Systems, Man, and Cybernetics.*
27) Sakakibara, H., Okada, N., and Hipel, K.W (2000): "Modeling public conflicts over infrastructure renewal using a Japanese case study," *IEEE Transition on Systems, Man, and Cybernetics.*
28) Sensarma, S.R., and Okada, N.: "Conflict and cooperation analysis by combined use of game theoretic and drama theory models: A case study of Yoshino River weir conflict, Japan", *International Journal of Risk Assessment and Management* (submitted for review).
29) Tokushima Work Office (Ministry of Construction) (1990): The Yoshino River - Its Outline and Conservation.
30) Von Neumann, J. and Morgenstern, O. (1944, 1953): *Theory of Games and Economic Behavior,* Princeton University Press, Princeton, New Jersey.
31) Web Page of Tokushima Shinbun (In Japanese): http://www.topics.or.jp/daijyuzeki/.

CHAPTER 6: SUMMARY OF OUTCOMES AND FURTHER RESEARCH NEEDS

This research has primarily focused on the different process of conflict resolution related to disaster and development, and has proposed a methodology for analyzing and examining policy implications for multi-stakeholder involved interactive decision making given case study areas, one from India, and other two from Japan. Different regional conflicts have been modeled in the strategic and dilemmatic perspectives. The main contributions of this thesis and some potential area of research are summarized in the next two sections.

6.1 Main Contributions

Chapter 1 has described the overview and background of this research including the aim and the organization of the thesis.

Chapter 2 has provided an overview of the proposed methodological approach in this research. It has been shown that combining GMCR, a game theoretic approach and Drama theory, a dilemma analysis approaches can give a comprehensive picture of the conflict resolution process. The fundamental principle of graph model methodology is that all the players have some feasible states, and that their moves are determined by the fixed set of preferences. Within this set of options and preferences players reach in different equilibria. They cannot change their preferences during their game, because it is against the rules of the game. On the other hand, drama theory comes up with a new notion where players (characters) no longer accept a set of their preferences as fixed. Characters communicate each others and redefine their game in terms of either changing their strategy or try to change opponents' options and preferences. Emotion plays a vital role to deconstruct player's subjective reality in their objective frame. Drama theory gives more focus on player's emotion-involved behavioral aspects of interactions in a dynamic process. This also emphasizes that such a perspective future can be created cooperatively by a group, rather than placing emphasis on conflict. This is the fundamental aspect of drama theory. GMCR based modeling is taken as a base of this research. The different equilibrium concepts give different strategies to resolve the conflict. GMCR can give an indication that which equilibrium apparently has been reached. Drama theory gives more focus on the player's position in the conflict which is somewhat neglected in the GMCR analysis. Positions are what characters (players) demanding, not what they are just prepared to accept (Bryant, 2006).

These two models are used in a complementary way. The elimination of each dilemma may require a different tactics. The game theoretic orientation of strategic moves gives insight to drama theory to redefine the character's (players) positions in respect of threats and promises to achieve the collaboration in a dynamic process. Further drama theory can also capture the creeping metaphases of the conflict. Combining GMCR and drama theory approaches is intended to bring an effective methodological leverage in this thesis.

Chapter 3 has provided a framework to analyze the player empowerment in the conflict resolution process, given a real social conflict in India. Theoretical procedures are developed to distinguish the actors and players in a strategic conflict. The conventional game theory implicitly assumes players to be complete in terms of three capacities i.,e, representability, knowledge, and executability. However in the real world, all the players are not always complete players. Depending on the extent to which these capacities are fulfilled by the players, it is proposed to systematically categorize the capacity status of a player, e.g., 'null player,' 'intermediate player' and 'complete player' in a game. The concept of representability, knowledge and executability is

defined in a game. This research examines the transformation process of stakeholders to become empowered by other actors and grow as a complete player in a game. Thus a game theoretic approach is used to examine how player's status affects the structure of the game and subsequently their strategic choices. To demonstrate this concept, first this idea is elaborated by illustrating the potential implications behind the standard and modified forms of Battle of Sexes (BOS) game by use of GMCR (Graph Model for Conflict Resolution), a game theoretic approach to conflict analysis. Further as a case study a real-world Rajaji National Park social conflict in India is modeled and the process of player empowerment is systematically analyzed and interpreted by GMCR. The formation of preferences and player's strategies is modeled in a game theoretic form in conjunction with social network approach. It has also shown that so far, more attention has to be paid to this kind of social network approach, and its strategy evolution in a game theoretic domain. Thus this chapter has contributed to enhancing awareness producing a prototype method for highlighting this unexplored research.

Chapter 4 has concentrated on analyzing player's strategic and behavioral aspects by using the combined GMCR and Drama theory methodologies in the Chizu-Ichinose community (Japan) disaster mitigation conflict which is seemingly resolved and then escalated. A combined approach is employed to understand the evolution of this conflict in a strategic and dilemmatic way. GMCR, a game theoretic approach provides a range of solution concepts under different strategic conditions. On the other hand, drama theory shows how the confrontation evolved over time and the characters engage in confrontation and keep changing their positions, preferences and perceptions through interactions with others. In the case of Chizu-Ichinose community disaster risk management conflict, the dilemma has arisen suddenly within a limited time to act strategically. The combined methodology of conflict analysis is used to systematically describe the process of structural change of this conflict which is already escalated. To look at the whole picture overall it is noteworthy of meeting the need for brining some integrated framework to systematically place this type of long-term conflict resolution process. For this purpose IRGC (International Risk Governance Council) framework is referred which consists of the cyclic process of pre assessment, risk appraisal, tolerability, and acceptability and risk management.

Chapter 5 intends to bring the new perspective of conflict and cooperation analysis in the Yoshino river weir conflict addressing combining game theoretic and drama theoretic approaches. The modeling and analysis of this case study shows how conflict can be resolved giving more emphasis on cooperation. In the case of Yoshino river weir conflict, it is shown how the characters (players) are in a continuous process to (de)construct their socially perceived reality in terms of changing their stands, beliefs and preferences.

Chapter 6 summarizes the main contributions of the research and refers to the needs for further extensions of this research.

6.2 Policy Implications

The interrelation between conflict and disaster is a very critical phenomenon which varies from developed to developing countries depending on the contextual setup. Hazards often trigger the conflict and this forces people to live into a vulnerability trap. This is quite common in developing countries. The vulnerability and conflict is shaped by social and economic factors rather than simply environmental factors. But in the developed countries, environmental and political factors have more influence rather than social and economic factors. These cross-cultural case studies give more analytical insights of knowledge development in the conflict resolution process which can be possible tested in the different parts of the world in similar situations. Table

1.1 (chapter 1) has shown the possible causes and consequences of these three different conflicts in a matrix form. Conflict resolution or reduction aspect must be addressed in disaster risk management policy in different levels, which is quite ignored in the arena of implementing knowledge and technology for disaster and development. For instance, case studies and accompanying methodological refinements have helped to derive social significant policy implications. Direct people participation such as participatory management can likely to reduce such conflict. This may need two levels of efforts to be made. One is research on institutional design of participatory democracy. This has been exemplified by the adoption of public referendum which has become popular in Japan as an institutional instrument of direct democracy. Another type of efforts is needed to systematically formulate, analyze, examine, and adaptively manage the process of participatory management.

6.3 Further Research

For this efforts to be achieved it is believed that the proposed methodology has proved, and will continue to prove to be an effective and powerful tool for scientifically support such efforts. The following points can be pointed out for further extension of this research.

- Further research is required to study the dynamic aspect of conflict and cooperation in terms of player's continuous (de)construction of their socially perceived reality until they find the cooperation ground. Though the potential synergies of drama theory and deconstruction approach is not yet explored so far. This will further enrich the theoretical development of drama theory in conflict analysis. Mutual complementary between GMCR and drama need implementation--oriented research to meet further theoretical study as well as field-based actual policy development needs.
- The game can be extended in the context of player's power position and hegemonic relation with others in a game.
- Policy research is to be conducted to examine systematic categorization of players' and actors' roles in conflict management.
- Policy research is to be conducted of meeting the need for brining some integrated framework to systematically place this type of long-term conflict resolution process. For this purpose we may well refer to the IRGC (International Risk Governance Council) framework consists of the cyclic process of pre assessment, risk appraisal, tolerability, and acceptability and risk management.